# TRbodora 

## JOURNAL OF THE <br> NEW ENGLAND BOTANICAL CLUB

March, 1972
No. 797

## REVISION OF THE GENUS MELAMPODIUM (COMPOSITAE: HELIANTHEAE) ${ }^{1}$

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Probably every plant collector in Mexico at some time during his travels has come upon large fields of weedy yellow-headed Compositae. More often than not, these herbs belong to the genus Melampodium. Such abundance of numbers, however, is not matched at all by our knowledge of the group, and in fact, the only comprehensive treatment of the genus is B. L. Robinson's synopsis published in 1901. Although this study brings together partial synonymy and provides a key for the group, all taxa are not adequately described nor does the key allow for easy and accurate identification. Many of the recent specimens being collected in Mexico and Central America have been extremely difficult if not impossible to identify satisfactorily. This incomplete understanding of relationships within Melampodium suggested that a thorough revision should be undertaken.

The present investigation is based on five years of study, including four months of field work and an examination of over 8000 herbarium specimens. The treatment presented here is essentially a straight-forward revision of Melampodium. Evolutionary considerations regarding the whole genus have been kept to a minimum as these evaluations have been the subject of a separate paper (Stuessy, 1971a).

[^0]Comments on probable phyletic relationships among selected species, however, are interspersed throughout the text, and data from experimental studies either in progress or already published are brought to bear on the relationships when appropriate. It is realized that many systematic problems still persist within Melampodium, but it is hoped that the present study dispels the confusion that has prevailed.

## TAXONOMIC HISTORY

The first description of Melampodium appeared in Linnaeus' Hortus Cliffortianus (1738) which was the reference cited in the Species Plantarum of 1753. Linnaeus in his Critica Botanica of 1737 (p.76) clearly indicated that the name he gave to the genus was derived from "Melampus medicus graecus." Apparently overlooking this explanation, many later workers (e.g., Gray, 1884; Cockerell, 1905) erroneously have believed the name to come from the Greek words meaning "black-foot."

From the time of Linnaeus' original description of $M$. americanum in 1738, the number of the species described in Melampodium has increased to over 88. Difficulties of specific circumscription and synonymy, resulting from the many described taxa, have been surpassed by the more perplexing problems dealing with generic and sectional delimitation. Because discussions have already been published on the history of generic problems associated with Melampodium (Stuessy, 1969b, 1970a), the following comments will emphasize the development of attempts to subdivide the genus.

Humboldt, Bonpland, and Kunth (1820) established the first subdivisions of the genus. Based primarily on the genera that were included in synonymy, they designated three groups (here recognized as subgenera) : Melampodia, Dysodia (Rich. in Pers.) H.B.K., and Alciniae (Cav.) H.B.K. No descriptions or comments were added to explain the rationale for the groupings beyond the inclusion of species.

Morphological criteria for the sections later recognized by Candolle (1836) were first stated by Cassini (1829). Cassini recognized the separate genera, Melampodium, Alcina, and a new genus, Zarabellia, all of which had inner phyllaries tightly enclosing and fused with a single ray achene, but each of which possessed distinctive characters as follows:

Melampodium L. (1) Inner phyllaries each crowned with a large hooded appendage (2) Sterile disc ovaries very large.

Zarabellia Cass. (1) Inner phyllaries with no hood but with two small valve-like processes (2) sterile disc ovaries nearly or completely absent.

Alcina Cav. (1) Inner phyllaries with no hood or valvelike processes and smooth at the sides (2) Sterile disc ovaries nearly or completely absent.

Candolle (1836) put Zarabellia and Alcina into Melampodium but maintained the taxa as three sections based on Cassini's bract differences: Eumelampodium DC., Zarabellia (Cass.) DC., and Alcina (Cav.) DC. Later, Bentham and Hooker (1873) and Hoffmann (1890) did not recognize sections in Melampodium, perhaps to stress the morphological unity of the genus (Turner and King, 1962). Baker, treating Brazilian species (1884), suggested two subgenera: Dysodium (Rich. in Pers.) H.B.K., and Unxia (L.f.) Baker, which were characterized by pedunculate and subsessile heads, respectively. Baillon (1882) departed significantly from previous authors by lumping Acanthospermum Schrank and Lecocarpus Dcne. into Melampodium, and these included genera formed the basis of his two recognized sections: Acanthospermum (Schrank) Baillon and Lecocarpus (Dcne.) Baillon.

Robinson in his synopsis of Melampodium (1901) submerged section Alcina (containing the single species, $M$. perfoliatum) into section Zarabellia. The two other sections of Candolle were retained on the basis of the hood versus non-hood bract character. Robinson acknowledged the variability of this feature but wrote that (p. 455)
". . . the presence or absence of a hood can usually be determined readily, and the two sections Eumelampodium and Zarabellia may conveniently be retained."

Using cytological data, Turner and King (1962) reopened considerations of sectional subdivision. Based on chromosome counts from 89 populations of 21 species $^{2}$, the taxa of section Melampodium (Eumelampodium DC.) were shown to be on a base of $x=10$, and the species within section Zarabellia to be multibasic with $x=9,11,12,16^{3}$ and $23^{4}$. In addition to bract and chromosome base number criteria, "small plants" and "densely pubescent or tomentose (rarely merely hispid) foliage" were suggested as characterizing section Melampodium, with "heterogeneous" morphology and "hispid pubescence" more indicative of section Zarabellia.

No one has ever proposed series within the two recognized sections of Melampodium. In fact, Robinson experienced frustration in attempting to create such order (1901, p. 455) : "Much difficulty has been experienced in giving the species a natural sequence, and after many efforts the hope of securing such an arrangement has been abandoned." Turner and King (1962) suggested that within the more morphologically heterogeneous section Zarabellia some formal subdivisions might be desirable after further study. They mentioned several informal groups such as: (1) "the small-headed, annual species having a chromosome base of $x=9$ "; (2) "those rhizomatous species centering about M. montanum with chromosome numbers on a base of $x=$ 11 "; and (3) "those annual species with large involucral bracts and smooth achenes having chromosome numbers of $n=11$ and $12 . "$

[^1]

Figs. 1-4. Disc florets of representative species of Melampodium showing the two different types of abortive ovaries. Figs. $1 \& 2$, M. leucanthum, Stuessy 752 (OS); Figs, 3 \& 4, M. divaricatum, Stuessy 547 (OS). Drawn from fresh material. The corollas and stamens in Figs. 2 and 4 have been removed, but they are the same florets as in Figs. 1 and 3, respectively. The arrow in Fig. 1 points to a marked annular constriction at the point of ovary and corolla tube juncture, which is characteristic of species in sect. Melampodium. That same marked constriction is absent from the florets of species in the other five sections of the genus (Fig. 3). Both types of ovaries are capped by ovarian discs (Figs. $2 \& 4$ ).

In the present treatment I depart significantly from previous workers by recognizing six sections in the genus. Based on coherence of morphology and chromosome numbers, section Melampodium seems a phyletic unit and therefore is retained, although here for the first time it is divided into five series. Section Zarabellia s.l. of previous authors, however, has been circumscribed in the past by
the absence of hoods of the inner phyllaries (to be discussed in detail later) and by the possession of chromosome numbers other than on a base of $x=10$ (i.e., $x=9$, 11, and 12). The only positive feature shared by all taxa of the section is the rudimentary ovary of the disc florets which contrasts markedly with the more conspicuous ovary of those taxa in section Melampodium (Figs. 1-4; these ovary differences mentioned earlier by Cassini, 1829, as having generic significance). The diversity of other morphological features and chromosome numbers in taxa of section Zarabellia s.l., however, suggests that the one unifying ovary feature may have been derived by parallel evolution (Stuessy, 1971a). From this phyletic viewpoint section Zarabellia s.l. seems an artificial unit and is therefore divided into five separate sections based on chromosomal and morphological differences. Two of the sections, Zarabellia s.str. and Rhizomaria, correspond respectively to the first two informal groups mentioned by Turner and King (1962). A list of the recognized sections, series, and included taxa follows:

Synopsis of Classification of Melampodium L.
I. Section Melampodium

1. Series Melampodium
2. M. americanum L. 2. M. diffusum Cass. 3. M. pilosum Stuessy 4. M. longipes (A. Gray) Robins. 5. M. linearilobum DC.
3. Series Leucantha Stuessy
4. M. leucanthum Torr. \& A. Gray 7. M. cinereum DC. 7a. M. cinereum DC. var. cinereum 7b. M. cinereum DC. var. hirtellum Stuessy 7c. M. cinereum DC. var. ramosissimum (DC.) A. Gray 8. M. argophyllum (A. Gray ex Robins.) Blake
5. Series Sericea Stuessy
6. M. sericeum Lag. 10. M. pringlei Robins. 11. M. strigosum Stuessy 12. M. longicorne A. Gray 13. M. nayaritense Stuessy
7. Series Cupulata Stuessy
8. M. cupulatum A. Gray 15. M. appendiculatum Robins. 16. M. sinuatum Brandg. 17. M. rosei Robins. 18. M. tenellum Hook. \& Arn. 19. M. glabribracteatum Stuessy
9. Series Longipila Stuessy
10. M. longipilum Robins.
II. Section Zarabellia (Cass.) DC.
11. M. longifolium Cerv. ex Cav. 22. M. mimulifolium Robins. 23. M. gracile Less. 24. M. microcephalum Less. 25. M. paniculatum Gardn.
III. Section Serratura Stuessy
12. M. divaricatum (Rich. in Pers.) DC. 27. M. costaricense Stuessy 28. M. dicoelocarpum Robins. 29. M. tepicense Robins. 30. M. sinaloense Stuessy
IV. Section Bibractiaria Stuessy
13. M. bibracteatum S. Wats. 32. M. repens Sessé \& Moc.
V. Section Rhizomaria Stuessy
14. M. montanum Benth. 33a. M. montanum Benth. var. montanum 33b. M. montanum Benth. var. viridulum Stuessy 34. M. aureum Brandg.
VI. Section Alcina (Cav.) DC.
15. M. perfoliatum (Cav.) H.B.K. 36. M. glabrum
S. Wats. 37. M. nutans Stuessy

DISTRIBUTIONAL SUMMARY
Melampodium is a tropical and subtropical genus mostly restricted to Mexico and Central America (Fig. 5) with four species located in the southwestern United States, and three species scattered in Colombia and Brazil. Although the Brazilian distributions could indicate South American origins for the two species, M. paniculatum and M. divaricatum, the fact that these species are found abundantly also in Central America and Mexico suggests that their presence in Brazil is due to recent introductions by man.


Fig. 5. Map of North and South America showing generalized distribution of Melampodium. Collections from Burma and the Philippine Islands not shown.

The exceedingly weedy nature of $M$. divaricatum and $M$. perfoliatum has allowed successful introductions of the genus to Burma, Cuba, Puerto Rico and the Virgin Islands. Another Mexican species, M. diffusum, has become established near Manila in the Philippine Islands.

Melampodium occupies primarily moist habitats from mountain pine-oak to tropical deciduous forests. Only two species, $M$. leucanthum and $M$. cinereum, are clearly xeromorphic, found in the drier regions of northern Mexico and adjacent United States.

## SPECIFIC AND VARIETAL CATEGORIES

It would be a formidable task to treat 37 species of a genus exhaustively with many experimental approaches to discover all the effective isolating mechanisms. As a result, in the present study a morphological species concept has been stressed. With the exception of chromosome numbers for many taxa, only in a few cases have data from experimental work been used to define more accurately the reproductive limits of each taxon. It is assumed, however, that the qualitative and quantitative morphological discontinuities formally recognized in this study do represent genetic differences that in some fashion are responsible for maintaining the integrity of each specific and varietal unit.

An attempt has been made to treat specific and varietal categories consistently with regard to the data available in each case. Varieties are regarded as morpho-geographical subdivisions of a species (Kapadia, 1964) that presumably reflect genetic differences.

## MORPHOLOGY AND TAXONOMIC CRITERIA

As an aid to understanding the specific and varietal categories used in the present study, the taxonomic value of various morphological features is discussed below:

Habit. - Both herbaceous annuals and suffruticose or rhizomatous perennials are found in the genus. The perennial habit is the less common condition found only in the following seven species of sections Melampodium and Rhizomaria: M. americanum, M. leucanthum, M. cinereum, M. argophyllum, M. sinuatum, M. montanum, and M. aureum.

Roots. - All taxa of the genus are tap-rooted except for the two rhizomatous perennial species of section Rhizomaria: M. montanum and M. aureum.

Leaves. - The shape, size, vesture, and type of margin of leaves are often useful as discriminating taxonomic characters at various levels in the hierarchy from section to variety. However, in some taxa leaf shape and size can be quite variable, especially in the widespread species, and this plasticity has been the cause of recognition of forms as species or varieties by previous workers (e.g., in M. divaricatum).

Vesture. - The surface of various organs ranges from glabrous to copiously sericeous, and the vesture often can be used as a reliable taxonomic character.

Heads. - Many features of the outer and inner involucral bracts and the ray florets are of diagnostic value. Within limits, the number of disc and ray florets is sometimes useful as a specific indicator, and as mentioned previously, the shape of the abortive ovaries of the disc florets is useful as a criterion for delimiting section Melampodium. "Fruit" in this treatment refers to the mature ray achene and enveloping inner involucral bract (Robinson, 1901). The fruits are often capped by extensions of the inner invelucral bracts of varying shapes and sizes upward from the achene apexes (Figs. 6-9). The presence of one particular type of extension called a "hood" (the term apparently first used by Cassini, 1829, and followed by most subsequent authors) correlates well with other features of section Melampodium. Within most species, however, the hood size, shape, and appendage vary considerably. In fact, the amount of variation prevalent among fruits in different plants of a single population (Fig. 10) and sometimes even among bracts in a single head (cf. Fig. 9E in Stuessy, 1970b) is astonishing. Such permutations, especially in the sculpturing of the lateral outer surfaces of the inner phyllaries, have been judged by some students of the group (e.g., Robinson, 1901) as indicative of varieties or even as distinct species. However, with few exceptions (such as in $M$. divaricatum and $M$. dicoelocarpum) the lateral bract surface features usually are not reliable as taxonomic characters.


Figs. 6-9. Representative fruits of Melampodium illustrating variation in achenal apexes. Fig. 6, M. glabrum, apex moderately sculptured, Stuessy 709 (OS); Fig. 7, M. longifolium, apex with abaxial protuberance, Sprengel s.n. (P) ; Fig. 8, M. longipilum, apex with adaxial awn, Stuessy 634 (OS); Fig. 9, M. leucanthum, apex with hood, Stuessy 752 (OS).


Fig. 10. Representative fruits of Melampodium linearilobum from a single population in Michoacán, Mexico (Stuessy 698, OS) illustrating variations in structure of the inner involucral bracts.

## TAXONOMIC TREATMENT

## MELAMPODIUM L.

Melampodium L. [Hort. Cliff. 425. 1738.] Sp. Pl. 921. 1753. Gen. Pl. ed. 5. 392. 1754. Type species: Melampodium americanum L .

Cargilla Adans. Fam. $2: 130$. 1763. nom. superfl. including Chrysogonum L. and Melampodium L.

Alcina Cav. Ic. 1:10. t. 15. 1791. Type species: Alcina perfoliata Cav. $=$ Melampodium perfoliatum (Cav.) H.B.K.

Dysodium Rich. in Pers. Syn. 2:489. 1807. non Dyssodia Cav. 1802. Type species: Dysodium divaricatum Rich. in Pers. $=$ Melampodium divaricatum (Rich. in Pers.) DC.

Melampodium L. subg. Alcina (Cav.) H.B.K. [as subg. Alciniae]. Nov. Gen. Sp. 4:274. 1820.

Melampodium L. subg. Dysodium (Rich. in Pers.) H.B.K. [as subg. Dysodia]. Nov. Gen. Sp. 4:273. 1820.

Melampodium L. subg. Melampodium [as subg. Melampodia]. H.B.K. Nov. Gen. Sp. 4:272. 1820.

Camutia Bonat. ex Steud. Nom. Bot. 146. 1821. pro syn., nom. nud. Based on Camutia perfoliata Bonat. ex Steud. Carnutia [attributed to Bonat. ex Steud. by] Baker in Martius, Fl. Bras. 6(3):159. 1884. Orthogr. var.

Zarabellia Cass. Dict. Sc. Nat. 59:240. 1829. [non Neck. 1790. invalid fide Art. 20, Intern. Code Bot. Nomen.] Type species: Zarabellia rhomboidea Cass. $=$ Melampodium longifolium Cerv. ex Cav.

Annual herbs to perennial subshrubs. Tap roots in all but 2 species ( $M$. aureum and $M$. montanum with fibrous roots and rhizomes). Stems decumbent to erect, terete to finely striate, dichotomously branched with peduncles arising from the middle and upper dichotomies. Peduncles very short and stout to long and filiform. Leaves opposite, decussate, linear to ovate-rhombic, at apex acuminate to obtuse, at base attenuate to auriculate-connate, with upper surfaces glabrous to pilose, with lower surfaces glabrous to sericeous, at margin entire to toothed. Heads solitary. Receptacle paleaceous, convex, sometimes elevated on a short cylindrical stalk $2-3 \mathrm{~mm}$ above the outer involucre.

Involucre biseriate. Outer involucre spreading to cupulate; bracts 2-5, more or less equal, with margins entire, separate to connate more than $2 / 3$ their length, with adaxial surface glabrous. Innermost phyllaries each enclosing a single ray achene, completely covering or sometimes partially open at apex, often extending upward into a hood or other apical appendage (Figs. 6-9). Ray florets $3-13$; ligules varying shades of yellow or cream-white ( 2 species), at the apex bior tri-dentate, attached on adaxial side of achene apex; tube nonexistent or very short; style branches filiform, flattened, obtuse at the apex, with stigmatic surfaces marginal and enlarged and running the length of the branches, recurved when fruit maturing; achenes asymmetrically obovoid and laterally compressed. Disc florets $3-110$; corollas yellowgreen to yellow-orange, regular, 5 -lobed (rarely 4 -lobed), with lobes partially reflexed or extended at right angles, throat salverform-funnelform; anthers brown, exserted from corolla $1 / 3-1 / 2$ their length; style linear-capillaceous, unbranched, exserted from within anthers; ovary sterile, capped by a disc; pappus absent. Paleae scarious, conduplicate around disc corollas. Chromosome numbers, $n=$ $9,10,11,12,18,20,23,25 \pm 1,27,30$, and 33 .

ARTIFICIAL KEY TO TAXA
a. Ligules white. (b)
b. Outer phyllaries connate more than half their length. (c)
c. Stems and leaves strigillose; leaves with margins usually entire-sinuate (less often pinnately lobed) ; heads $20-37 \mathrm{~mm}$ diam ${ }^{5}$; ligules $7-13 \mathrm{~mm}$ long, $2.5-8 \mathrm{~mm}$ wide; plants $15-50 \mathrm{~cm}$ tall
6. M. leucanthum
c. Stems and leaves canescent-tomentose; leaves with margins usually pinnately lobed-parted (less often entire) ; heads $10-23 \mathrm{~mm}$ diam; ligules $2.5-9 \mathrm{~mm}$ long, $1.5-4.5 \mathrm{~mm}$ wide; plants $12-$ 22 cm tall ................ 8. M. argophyllum

[^2]b. Outer phyllaries connate a third or less their length. (d)
d. Leaves with basal margins hispid with hairs 0.61.5 mm long; stems strigose-hispid with hairs $0.2-1.5 \mathrm{~mm}$ long . 7b. M. cinereum var. hirtellum
d. Leaves with basal margins strigose with hairs $0.3-0.6 \mathrm{~mm}$ long; stems strigose with hairs $0.1-$ 0.8 mm long. (e)
e. Leaves linear, 7-32 mm long, 2-5 mm broad; heads $3-5 \mathrm{~mm}$ tall; outer involucre $4.5-9 \mathrm{~mm}$ diam; outer phyllaries 2.7-4 mm long, 1.32.8 mm wide; hood $0.8-1.5 \mathrm{~mm}$ tall

7c. M. cinereum var. ramosissimum e. Leaves linear-oblong, 12-55 mm long, 1-14 mm broad; heads $5-8 \mathrm{~mm}$ tall; outer involucre $7-14.3 \mathrm{~mm}$ diam ; outer phyllaries $3.5-7.3 \mathrm{~mm}$ long, 2.3-5 mm wide; hood 1.3-2.9 mm tall . . 7a. M. cinereum var. cinereum
a. Ligules yellow. (f)
f. Outer phyllaries 2. (g)
g. Leaves oblong to obovate-oblanceolate; ray florets 5-6 (rarely 3) ; stems erect to decumbent; plants subaquatic ........ 31. M. bibracteatum
g. Leaves obovate; ray florets 2-3; stems prostrate; plants terrestrial . . . . . . . . . . . . 32. M. repens
f. Outer phyllaries 3-5. (h)
h. Outer phyllaries 3. (i)
i. Heads $3-5.5 \mathrm{~mm}$ diam; ligules usually less than 2 mm long; peduncles copiously stipi-tate-glandular ........ 25. M. paniculatum
i. Heads $5-15 \mathrm{~mm}$ diam; ligules usually more than 2 mm long; peduncles strigillose to hispid to weakly stipitate-glandular. (j) j. Leaves subauriculate at base
23. M. gracile
j. Leaves attenuate to obtuse at base. (k) k. Leaves with tapering petioles $1-3 \mathrm{~cm}$ long; inner phyllaries open in a small
hood at achene apex, often extended into awn ..... 37. M. nutans
k. Leaves sessile or with petioles 0.1-0.4 cm long; inner phyllaries completely closed over achene apex, with no extended appendage
24. M. microcephalum
h. Outer phyllaries 5. (1)

1. Leaves sericeous beneath. (m)
m . Outer phyllaries with the margin scarious ................... 5. M. linearilobum
m . Outer phyllaries with the margin herbaceous. (n)
n. Leaves narrowly ovate to lanceolate. (o)
o. Plants perennial ; heads $11-17 \mathrm{~mm}$ diam; ligules $4-6 \mathrm{~mm}$ long
2. M. americanum
o. Plants annual; heads $6-11 \mathrm{~mm}$ diam; ligules 2.5-4.5 mm long. (p) p. Plants $8-28 \mathrm{~cm}$ tall; stems pilose; outer phyllaries ovate to narrowly ovate; leaves copiously sericeous beneath
3. M. pilosum
p. Plants $25-40 \mathrm{~cm}$ tall; stems stri-gillose-hispidulous; outer phyllaries ovate; leaves moderately sericeous beneath
4. M. diffusum
n. Leaves linear, oblanceolate, or deeply pinnately divided. (q)
q. Ligules 2 mm long or less. (r) r. Leaves linear and entire to deeply pinnately divided; ligules ca 2 mm long; heads $8-11 \mathrm{~mm}$ diam; disc florets 15-25
5. M. nayaritense
r. Leaves linear-oblong to oblanceolate, often lobed or parted; ligules ca 1 mm long; heads 4 8 mm diam; disc florets 2 12. (s)
s. Peduncles $5-22 \mathrm{~mm}$ long; dise florets 5-12; ligules on undersurface yellow at apex; outer involucre 6-11 mm diam .. 9. M. sericeum
s. Peduncles 1-2 mm long; disc florets 2-3; ligules on undersurface purple at apex; outer involucre $3-4 \mathrm{~mm}$ diam 10. M. pringlei
q. Ligules more than 2 mm long. ( t )
t. Plants annual; stems yellow to green .......... 4. M. longipes
t. Plants perennial; stems purple to green .... 1. M. americanum
6. Leaves glabrous or strigose beneath. (u)
u. Outer phyllaries with the margin narrowly scarious. (v)
v. Peduncles 1.3-1.7 cm long; outer phyllaries abaxially glabrous ............. 19. M. glabribracteatum v. Peduncles usually more than 2 cm long; outer phyllaries abaxially subglabrous, strigose or pilose. (w)
w. Plants perennial with fibrous roots and rhizomes. (x)
x. Heads $19-38 \mathrm{~mm}$ diam; ligules yellow-orange to yellow, 5-13 mm long; disc corollas yellow; fruit 2-2.3 mm long ${ }^{6}$; chromo-

[^3]some number, $n=33$
34. M. aureum
x. Heads $11-21 \mathrm{~mm}$ diam; ligules yellow, $4-7.5 \mathrm{~mm}$ long; disc corollas yellow-green; fruit 1.61.8 mm long; chromosome number, $n=11$. ( y )
y. Ligules on undersurface light green at apex and on veins .. 33b. M. montanum var. viridulum
y. Ligules on undersurface dark purple at apex and on veins .. 33a. M. montanum var. montanum
w. Plants annual or perennial with tap roots. (z)
z. Plants perennial; leaves on undersurface copiously tomentose, at margin markedly sinuate . .
16. M. sinuatum
z. Plants annual ; leaves on undersurface strigose, at margin entire, lobed or divided. (aa) aa. Leaves at base attenuate. (bb)
bb. Outer phyllaries ovate to narrowly ovate, $4-6 \mathrm{~mm}$ long; heads 7-8 mm tall . ....... . 14. M. cupulatum
bb. Outer phyllaries ovate to orbiculate, $\quad 2.5-3.5 \mathrm{~mm}$ long; heads $3.5-5.5 \mathrm{~mm}$ tall .... 18. M. tenellum aa. Leaves at base obtuse to subauriculate. (cc)
cc. Outer phyllaries connate $2 / 3$ their length
15. M. appendiculatum cc. Outer phyllaries connate less than $1 / 4$ their length
17. M. roser
u. Outer phyllaries with the margin herbaceous. (dd)
dd. Outer involucre $15-32 \mathrm{~mm}$ diam; outer phyllaries $6-20 \mathrm{~mm}$ long; fruits $4-7 \mathrm{~mm}$ long; lower leaves conspicuously perfoliate at base .... 35. M. perfoliatum
dd. Outer involucre 3-10 (-14) mm diam; outer phyllaries 2-6(-6.8) mm long; fruits 1.6-3(-4) mm long; lower leaves attenuate to subauriculate at base. (ee) ee. Leaves markedly petiolate. (ff)
ff. Ligules $3.5-7 \mathrm{~mm}$ long. ( gg )
gg. Fruit at apex with a flattened adaxial appendage extending upward into a cirrhous awn (Fig. 8) .... 20. M. longipilum gg. Fruit at apex variously ridged and sculptured but not as above 26. M. divaricatum ff. Ligules less than 3 mm long. (hh) hh. Fruit on lateral surfaces with 2 deep oval cavities 28. M. dicoelocarpum hh. Fruit on lateral surfaces variously ribbed, tubercled, and sculptured but not as above. (ii)
ii. Heads $6-10 \mathrm{~mm}$ diam; stems usually $2-4 \mathrm{~mm}$ diam ........ 27. M. costaricense
ii. Heads $3-5 \mathrm{~mm}$ diam; stems usually less than 2 mm diam. (jj)
jj. Peduncles $0.8-8 \mathrm{~mm}$ long;

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$$
\begin{aligned}
& \begin{array}{l}
\text { outer phyllaries ovate or nar- } \\
\text { rowly ovate. (oo) } \\
\text { oo. Leaves attenuate at base .... } \\
\text {.... 24. M. microcephalum } \\
\text { oo. Leaves subauriculate to ob- } \\
\text { tuse at base. (pp) } \\
\text { pp. Stems copiously pilose near } \\
\text { apex; outer phyllaries } \\
\text { ovate-lanceolate, } 5-6 \text { mm } \\
\text { long, at apex acute .... } \\
\text { 22. M. mimulifolium } \\
\text { pp. Stems moderately hispid- } \\
\text { pilose and weakly stipitate- } \\
\text { glandular near apex; outer } \\
\text { phyllaries ovate, 3.5-5 mm } \\
\text { long, at apex acuminate } \\
\text {.......... 23. M. gracile }
\end{array}
\end{aligned}
$$
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## I. MELAMPODIUM section Melampodium

Melampodium L. sect. Eumelampodium DC. Prodr. 5:518. 1836. Type species: Melampodium americanum L .

Tap-rooted annuals or perennials; leaves linear to ovate, sessile to markedly petiolate, with margins entire or lobed or obscurely serrate; outer involucre cupulate, with bracts 5 , at margins herbaceous or scarious ; ovaries of the disc florets linear, 1.2-2.3 mm long; tube of disc florets with a marked basal annular constriction at point of ovary juncture (Fig. 1, arrow) ; fruits usually capped (Fig. 9) with a hood (absent in $M$. pringlei, and $M$. sinuatum; sometimes absent in M. americanum, M. hispidum, M. longicorne, and M. sericeum ; rudimentary in $M$. cupulatum) or with a flattended adaxial awn (M. longipilum, Fig. 8) ; chromosome base number, $x=10$. Species 1-20.

## 1. Series MELAMPODIUM

Annual herbs or suffruticose perennials (in M. americanum) ; leaves narrowly ovate to linear, often pinnately divided, sericeous beneath, ligules orange-yellow, more than
or rarely about 2 mm long ; margins of outer phyllaries herbaceous or scarious (in $M$. linearilobum); fruits usually hooded. Species 1-5. Type species: Melampodium americanum L .

1. Melampodium americanum L. [Hort. Cliff. 425. 1738.] Sp. Pl. 921. 1753. tYpe: mexico: Veracruz, near Veracruz, Mar 1731, W. Houstoun s.n. (Holotype, Bm; photograph of holotype, NY! US!; photograph of Bм isotype, US!).

Calendula decumbens Mill. Gard. Dict. ed. 8. n. 9. 1768. nom. superfl., based on type of Melampodium americanum.

Melampolium heterophyllum Lag. Gen. et Sp. Nov. 33. 1816. TYPE: "nova hispania": grown in Roy. Bot. Gard. Madrid, source and collector of seeds uncertain (Holotype, MA? ; tracing of DC isotype [?], GH!).

Melampodium sericeum H.B.K. Nov. Gen. Sp. 4: 272, t. 398. 1820. non Lag. 1816. nom. illegit. TYPE: MEXICO: Guerrero, between Tehuilotepec and Taxco, 5520 ft , Apr 1803, A. J. Bonpland 3968 (Holotype, P; isotype, P!; fragment of holotype, P! US!; photograph of P isotype, os ! TEX!; photograph of probable B isotype, TEX!).

Melampodium angustifolium DC. Prodr. 5:519. 1836. tYPE: PERU [?]: "in Peruviae montanis, ad Oronocum," 1790-91, T. Haenke s.n. (Holotype, Pr; isotypes, P [2]!; probable isotype, F!; photograph of G-DC isotype, F! NY! US! IDC! 800. 927: III.1!'; photograph of P isotype, os! TEX!). If the collection actually is from Peru, then the range of $M$. americanum would be extended much further south than its present southern limit in Guatemala. However, apparent mixing of label data of Haenke's specimens has been reported in at least three instances by other

[^4]workers (Hitchcock, 1909; Merrill, 1925; Tryon, 1955). Because Haenke also collected in Mexico in the region from Acapulco to Mexico City (Safford, 1905; Alston, 1934) where M. americanum is common, it seems likely that mixing of label data also has occurred here.

Melampodium kunthianum DC. Prodr. 5:519. 1836. nom. nov. Based on type of $M$. sericeum H.B.K.

Melampodium nelsonii Greenm. Proc. Amer. Acad. Arts \& Sci. $41: 260.1905$. TYPE: MEXICO: Michoacán, Volcano of Jorullo, 28 Mar 1903, E. W. Nelson 6939 (Lectotype chosen, GH!; isotypes, NY! US!; photograph of US isotype, TEX!).

Perennial subshrubs, $15-60 \mathrm{~cm}$ tall. Stems ascending, 1-2 mm diam, strigose to hispid-pilose with hairs $0.2-1 \mathrm{~mm}$ long. Peduncles 2.5-7.5 cm long. Leaves sessile, linear to ovate, $3-6 \mathrm{~cm}$ long, $0.2-2.7 \mathrm{~cm}$ wide, at apex acute-obtuse, at base attenuate to obtuse, with upper surface strigose with hairs $0.2-0.5 \mathrm{~mm}$ long, with lower surface sericeous; margin entire or lobed to pinnately divided into linear segments, at base usually pilose-hirsute with hairs up to 1 mm long. Heads $7-8 \mathrm{~mm}$ tall, $11-17 \mathrm{~mm}$ diam. Outer involucre cupulate, $7-10 \mathrm{~mm}$ diam; bracts 5 , slightly connate at base, imbricate $2 / 3$ their length (rarely separate), ovate to rhombic, $5-7 \mathrm{~mm}$ long, $3-4 \mathrm{~mm}$ wide, at apex acuminate, with abaxial surface strigose with hairs 0.5 mm long near apex, near base pilose to sericeous, at margin herbaceous. Fruits 2-3 mm long, with lateral surfaces smooth with ribs and few tubercles to verrucate-aculeate; hood apex mucronate (rarely muticous) to cirrhous, with tapering appendage up to 3 mm long. Ray florets $8-13$; ligules yellow-orange, oblongelliptic, $4-6 \mathrm{~mm}$ long, $1.5-3 \mathrm{~mm}$ wide. Disc florets $50-100$; corollas yellow-orange, 2.1 mm diam, with throat and tube each 1 mm long. Paleae oblanceolate, 4 mm long, 1 mm wide; apex yellow, with margin entire to undulate becoming dentate-erose laterally; midrib prominent, pubescent with hairs 0.4 mm long. Chromosome number, $n=10$.


Fig. 11. Map of Mexico and adjacent Guatemala showing distribution of Melampodium americanum (dots), M. glabribracteatum (square), and $M$. pringlei (triangle). Three collections of $M$. americanum near Tepic, Nayarit, not shown.

Habitats ranging from savannas to pine-oak forests in Mexico on the eastern slope of the Sierra Madre Oriental and on the western slopes of the Sierra Madres Occidental and Sur, with extensions into Guatemala (Fig. 11), 2102380 m . Flowering dates, Jan-Aug.

This species is very widespread, ranging from north in Tamaulipas, Mexico, to south into Guatemala and is found in diverse habitats from mountain pine forests to lowland savannas. As might be expected from such geographical
and ecological diversity, much morphological variability also is present. Although no formal varieties are proposed at this time, morpho-geographic trends do exist that need further study: (1) plants with short leaves with few and broad lobes and large heads found in the coastal lowlands near Alvarado, Veracruz; (2) plants with long leaves, pinnately divided into narrow lobes, found in the mountains of Chiapas and Guatemala; (3) short plants with small heads and a tendency toward the annual habit found in the mountains of the western Sierra Madre in Jalisco, Michoacán and Guerrero.

Three collections (Feddema 832; King 3699; Rose, Standley and Russell 14307) found in the northwestern range of this species (north of Tepic, Nayarit) also may deserve formal taxonomic status. The outer involucral bracts of these collections are more rhombic with narrower attenuate apexes as compared with the more typical ovate bracts of the rest of the species, and the ligules are longer and narrower than usual. A collection from Guerrero, however, Hinton 9134, approaches these Nayarit collections and seems to vitiate clear varietal or specific recognition. Obviously additional work, especially in the Tepic area, is needed.
representative specimens: Guatemala. baja verapaz: ca 3 mi S of Salamá, 10 Jul 1960, King 3260 (DS, Ny, TEX, UC, US) ; ca 14 mi W of Salamá, 14 Jul 1960, King 3358 (DS, NY, tex, Uc, US) ; ca 15 mi S of Rabinal, 14 Jul 1960, King 3364 (DS, NY, tex, UC, US). el progreso: 35 mi NE of Guatemala, 30 Jul 1966, Stuessy 602 (tex). huehuetenango: Uaxackanal, 1 Aug 1896, Volkem 2973 (F [photograph of US specimen], gh, NY, US). Mexico. ChiApAS: ca 10 mi E of the Oaxaca-Chiapas border on rte 190, 23 Jun 1960, King 2980 (dS, NY, TEX, UC, US) ; ca 12 mi E of Cintalapa, 23 Jun 1960, King 2987 (dS, ny, tex, UC, US) ; ca 33 mi S of Tuxtla Gutiérrez, 27 Jun 1960, King 3105 (DS, NY, TEx, UC, US) ; 30 mi SE of Comitán, 26 Jul 1966, Stuessy 571 (tex) ; 1 mi N of Entronque Santa Isabel, 10 Aug 1966, Stuessy 632 (tex). Colima: Colima, 24 Oct 1910, Orcutt 4516 (DS, F, GH) ; Colima, 9 Jan-6 Feb 1891, Palmer 1172 (G, GH, NY, UC, US) ; 5 mi NW of rte 110 on rd to Alzada, 25 Aug 1966, Stuessy 724 (TEX); Alzada, 25 Aug 1966, Stuessy 727 (tex); Manzanillo, 1863-64, Xantus s.n. (F, GH [2], Ny [2], us [2]). Guerrero:

Placeres, Puerta, 22 Jul 1936, Hinton 9134 (ariz, tex, us) ; ca 9 mi NW of Taxco, 14 Mar 1961, King 4168 (F, NY, TEX, UC, US) ; ca 25 mi NE of Acapulco, 14 Mar 1961, King 4178 (F, Ny, tex, uc, uS). Jalisco: Río Cuvianes, 13 Jun 1892, Jones 274 (pom [2], US); Río Cuvianes, 13 Jun 1892, Jones 369 (pom, us) ; $1 / 2 \mathrm{~km}$ S of Puente San Pedro on rd from Colima to Ciudad Guzmán, 31 Jul 1960, Koeppen \& Ittis 618 (TEX, UC) ; 10 mi S of Autlán toward La Resolana, 28 Jun 1949, R. \& C. Wilbur 1395 (US). méxico: 8 km SW of Luvianos, 2 Sep 1965, Rzedowski 20748 (os). michoacán: Coalcomán, 5 Jan 1939, Hinton et al. 12871 (NY, US) ; Uruapán, Tancitaro, 26 Oct 1940, Hinton et al. 15587 (ariz, GH, TEX, US) ; ca 32 km N of Playa Azul (near Los Encinos), 25-31 Oct 1961, King \& Soderstrom 4992 (ny, SMU, TEX, UC, US) ; Apatzingán, canyon below Acahuato, 15 Aug 1941, Leavenworth \& Hoogstraal 1589 (F, GH); 7 mi S of Ario de Rosales, 20 Aug 1966, Stuessy 688 (TEX). NAyarit: Mirador del Águila, ca 14 mi N of Tepic, 21 Aug 1959, Feddema 832 (місн [2]); ca 25 mi N of Tepic, 12 Aug 1960, King 3699 (DS, NY, TEX, UC, US); vicinity of Acaponeta, Tepic, 10 Apr 1910, Rose, Standley \& Russell 14307 (us); Ixtlán del Río - San Marcos, 5 Aug 1921, Thompson s.n. (Ny). oaxaca: Estación San Marcos, Istmo de Tehuantepec, 21 Jan 1907, Conzatti 1706 (F, GH, US) ; vicinity of Yalalag [Hidalgo Yalalag], Jul 1894, Nelson 947 (US); rd between Llano Grande \& Pinotepa, 19 Feb 1895, Nelson 2339 (US); between Guichocovi \& Lagunas, 27 Jun 1895, Nelson 2740 (GH, US). SAN Luis potosí: San Dieguito, 13-16 Jun 1904, Palmer 459 (us). tamaulipas: 10 km NW of El Progreso, 22 Aug 1941, Stanford, Retherford \& Northeraft 1077 (ariz, dS, GH, ny, UC). veracruz: La Purga, 27 Jan 1906, Greenman 279 (F, GH, NY) ; ca 26 mi E of Cuitláhuac, 6 Jun 1960, King 2682 (DS, Ny, TEx, UC, US) ; ca 14 mi SE of Alvarado, 7 Jun 1960, King 2718 (DS, NY, TEx, UC, US) ; vicinity of Pueblo Viejo, 2 km S of Tampico, 1-2 Jun 1910, Palmer 535 (GH, NY, US) ; 63 mi S of jet rtes 110 \& 105, 6 Jul 1966, Stuessy 471 (TEX).
2. Melampodium diffusum Cass. Dict. Sci. Nat. 59:238. 1829. TYPE: PHILIPPINE ISLANDS: Manila, summer 1825, F. L. Busseuil s.n. (Holotype, P?).

Melampodium manillense Less. Linnaea 6:155. t. 2, f. G (fruit). 1831. TYPE: PHILIPPINE ISLANDS: "in Luçonia" [Luzon], 1831, A. Chamisso s.n. (Holotype, B? ; photograph of G-DC isotype (?), IDC 800. $927:$ I. 6!).

Melampodium lanceolatum DC. Prodr. 5:519. 1836. TYPE: PHILIPPINE ISLANDS or MEXICO: locality and date unknown, L. Née s.n. (Holotype, G-DC ; isotype, MA!; photo-
graph of holotype, US!, IDC 800. 927 :II. 6 !; photograph of MA isotype, OS! TEX!).

Melampodium diffusum Cass. var. lancelatum (DC.) Robins. Proc. Amer. Acad. Arts \& Sci. 36:460. 1901.

Annual herbs, $25-40 \mathrm{~cm}$ tall. Stems erect, $1-5 \mathrm{~mm}$ diam, subglabrous at base to strigillose-hispidulous above with hairs up to 0.8 mm long. Peduncles $0.8-6.5 \mathrm{~cm}$ long. Leaves usually sessile (sometimes with petioles up to 3 mm long), lanceolate to narrowly ovate, $2.5-5.5 \mathrm{~cm}$ long, $0.5-1.5$ (-3) cm wide, at apex acute, at base attenuate to somewhat obtuse, with upper surface strigose with hairs 0.3 mm long, with lower surface sericeous; margin entire to 1-3 cleft, hispid with hairs up to 1.5 mm long. Heads $5-7 \mathrm{~mm}$ tall, $6-11 \mathrm{~mm}$ diam. Outer involucre cupulate, $5-9 \mathrm{~mm}$ diam; bracts 5 , slightly connate at base, imbricate $1 / 2$ their length, ovate, $2.5-6 \mathrm{~mm}$ long, $1.5-4 \mathrm{~mm}$ wide, at apex acuminate, with abaxial surface strigillose with hairs 0.3 mm long, at margin herbaceous. Fruits $1.8-2.3 \mathrm{~mm}$ long, with lateral surfaces smooth and longitudinally ribbed to tuberculateaculeate; hood apex mucronate to cirrhous (rarely muticous) ${ }^{8}$, with appendage up to 2 mm long. Ray florets $8-13$; ligules yellow-orange, oblong-elliptic, 2.5-4 mm long, 1-3 mm wide. Disc florets 40-60 ; corollas yellow-orange, 1.3 mm diam, with throat 0.6 and tube 0.4 mm long. Paleae oblanceolate, 3 mm long, 0.9 mm wide; apex yellow, with margin entire to moderately erose ; midrib prominent, mostly glabrous. Chromosome number, $n=10$.

Tropical deciduous forests in Colima and near Acapulco, Guerrero, Mexico, and Manila in the Philippine Islands (Fig. 12), 30-300 m. Flowering dates, Jun-Jan.

One collection, Winbery \& Rowell 2492, approaches the perennial habit in this characteristically annual species. Because this collection also possesses heads and leaves larger than usual, the suggestion of hybridization with nearby $M$. americanum, especially at higher altitudes in Guerrero, cannot be excluded.

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Fig. 12. Map of Mexico, adjacent Guatemala, and the Philippine Islands (inset), showing distribution of Melampodium diffusum (triangles), M. longifolium (closed squares), M. longipilum (dots), M. mimulifolium (open square), and M. pilosum (circles).

Robinson (1901, p. 456) previously noticed the unusual bicentric distribution of this species and offered the following plausible explanation:
"As the genus is otherwise American, the occurrence of this species in a region so remote has always been problematic, and it has been a matter of no small interest to find the Philippine plant closely matched by specimens recently collected by Dr. Edward Palmer, about Acapulco, Mexico. There can therefore be scarcely a doubt that the genus is in reality of New World origin, and that a single Mexican species was accidentally introduced into the Philippines, where it attracted scientific attention before it was recognized in America. This seems the more likely from the circumstance that Mexico and the Philippines were under the same national control, and early con-
nected by a certain amount of oceanic traffic [demonstrated by Merrill (1954)]. This being the case, the transference of seed from Acapulco, the most important Pacific port of Mexico, to the neighborhood of Manila, presents no inherent improbability."
representative specimens. Mexico. colima: $5-10 \mathrm{mi}$ N of Tecomán, 25 Dec 1958, Thompson \& Fields 332 ( TEX). GuERRERO: above Playa Hornos ca 1 mi E of Acapulco, 9 Jan 1944, Barkley 14142 (F, GH, POM, TEX, UC, US) ; near Pie de la Cuesta NW of Acapulco, 5 Jan 1944, Barkley 14163 (TEX, US) ; 20 mi NE of Acapulco, 20 Aug 1947, Barkley, Webster \& Paxson 17M724 (TEX) ; between Acapulco \& Pueblo Nuevo, 13 Nov 1882, Hancock 25 (F, K) ; 8 mi E of Acapulco, 22 Jun 1952, Mockford \& Rowell 2769 (SMU) ; near Acapulco, 25-31 Oct 1895, Palmer 3 (F, GH, NY, UC, US) ; near Acapulco, Dec 1895, Palmer 281 (GH, US) ; 26 mi W of Acapulco, 19 Aug 1961, Powell \& Edmondson 758 (F, TEX) ; 5 mi SW of Tierra Colorada, 17 Jun 1952, Winbery \& Rowell 2492 (SMU) ; 1 mi N of Acapulco, 27 Aug 1965, Stuessy 366 (TEX) ; near $S$ shore of Acapulco bay, 28 Aug 1965, Stuessy 369 (tex). Philippine Islands. Luzon: Cavite, Aug 1905, Foxworthy 167 (NY, US); Cavite, Binacayan, 21 Jan 1917, Merrill 10641 (NY, US) ; Cavite, Bacoor, Jul 1910, Robinson 11835 (F) ; Laguna, 17 Apr 1953, Canicosa 1103 (US) ; Nueva Vizcaya, Bambang, Jan 1924, Clemens s.n. (Uc) ; Nueva Vizcaya, Benquet, Dec 1908, Curran \& Merritt 15837 (Us) ; Nueva Vizcaya, Jan 1913, McGregor 20181 (US).
3. Melampodium pilosum Stuessy, Brittonia 22:115. f. 6 . 1970. TYPE: MEXICO: Guerrero, Montes de Oca, Vallecitos, 28 Sep 1937, G. B. Hinton 11428 (Holotype, NY!; isotypes, G! GH! UC! US!).

Annual herbs, $8-28 \mathrm{~cm}$ tall. Stems erect to decumbent, 1-2 mm diam, pilose with hairs up to 1.5 mm long. Peduncles $3-3.7 \mathrm{~cm}$ long. Leaves with petioles 2 mm long, lanceolate to narrowly ovate, $3-6 \mathrm{~cm}$ long, $1-1.3 \mathrm{~cm}$ wide, at apex acute, at base obtuse, with upper surface near apex strigose with hairs 0.3 mm long, near base pilose with hairs 1.5 mm long, with undersurface markedly sericeous; margin entire to rarely 1-2 lobed, irregularly ciliate with hairs 0.3 mm long, toward base pilose with hairs up to 2 mm long. Heads $6-7 \mathrm{~mm}$ tall, $7.5-11 \mathrm{~mm}$ diam. Outer involucre cupulate, $6.5-9 \mathrm{~mm}$ diam ; bracts 5 , slightly connate at base, im-
bricate $1 / 2$ their length, ovate to narrowly ovate, $4-5 \mathrm{~mm}$ long, 2-2.5 mm wide, at apex acuminate, with abaxial surface pilose with hairs 1 mm long, at margin herbaceous. Fruits $1.6-2.5 \mathrm{~mm}$ long, with lateral surfaces 3 -ribbed and smooth to very weakly tuberculate; hood apex mucronate to cirrhous ${ }^{9}$, with tapering appendage up to 2 mm long. Ray florets 7-8; ligules yellow-orange, ovate-oblong, 3-4.5 mm long, 2-3 mm wide. Disc florets $55-80$; corollas yellow, 1.2 mm diam, with throat and tube each 0.7 mm long. Paleae oblanceolate, 4 mm long, 1 mm wide; apex yellow, with margin erose becoming laciniate laterally; midrib prominent, hirsutulous with hairs 0.3 mm long. Chromosome number, $n=10$.

Tropical deciduous forests in Michoacán and Guerrero, Mexico (Fig. 12), 910-1220 m. Flowering dates, Aug-Sep.
representative specimens. Mexico. guerrero: Coyuca, Chacamerito, 14 Aug 1934, Hinton 6436 (F, G, GH, Ny [2], US). michoacán: ca 1 mi N of Huacana, 11 Aug 1965, Melchert \& Sorensen 6085 (ENCB); 25 mi S of Ario de Rosales, 20 Aug 1966, Stuessy 695 (TEX).
4. Melampodium longipes (A. Gray) Robins. Proc. Amer. Acad. Arts \& Sci. 36:459. 1901.

Melampodium sericeum Lag. var. longipes A. Gray. Proc. Amer. Acad. Arts \& Sci. 22:423. 1887. TYPE: mexico: Jalisco, Tequila, "base of mountains," Aug 1886, E. Palmer 391 (Holotype, GH!; isotypes, G! K! Mo! NY [2]! US!; photograph of US isotype, TEX!).

Annual herbs, $10-46 \mathrm{~cm}$ tall. Stems erect, $1-2 \mathrm{~mm}$ diam, hispid-pilose with hairs up to 1 mm long. Peduncles $5-8$ cm long. Leaves sessile, linear and entire to markedly pinnately parted, $3-7 \mathrm{~cm}$ long, $0.3-3.5 \mathrm{~cm}$ wide, at apex acuteobtuse, at base mostly attenuate (less often obtuse), with upper surface strigose with hairs $0.3-1 \mathrm{~mm}$ long, with lower surface sericeous; margin entire, at base hispid-pilose with hairs up to 2 mm long. Heads $6.5-8.5 \mathrm{~mm}$ tall, $10-12 \mathrm{~mm}$

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Fig. 13. Map of central Mexico showing distribution of Melampodium dicoelocarpum (triangles), M. glabrum (dots), M. longipes (squares), and M. nutans (circles). One collection of M. nutans from Oaxaca not shown.
diam. Outer involucre cupulate, $7-8 \mathrm{~mm}$ diam; bracts 5 , slightly connate at base, imbricate $2 / 3$ their length, obovate, $4-5 \mathrm{~mm}$ long, $2.5-3 \mathrm{~mm}$ wide, at apex acuminate, with abaxial surface pilose with hairs 1 mm long (more dense near base) ; margin herbaceous. Fruits $2-3 \mathrm{~mm}$ long, with lateral surfaces tuberculate with 3-4 longitudinal ribs; hood apex mucronate to cirrhous, with tapering appendage up to 3 mm long. Ray florets $8-10$; ligules yellow-orange, ovateoblong, $3-5 \mathrm{~mm}$ long, $1-3 \mathrm{~mm}$ wide. Disc florets $50-80$; corollas yellow-orange, 2 mm diam, with throat 0.8 mm and tube 0.7 mm long. Paleae oblanceolate, 3.5 mm long, 0.8 mm wide; apex yellow, with margin entire to undulate; midrib distinct, mostly glabrous. Chromosome number, $n=10$.

Dry hillsides in Jalisco, Nayarit and Sinaloa, Mexico (Fig. 13), ca 1220 m . Flowering dates, Aug-Sep.

This species is very similar to both $M$. americanum and M. linearilobum. M. longipes usually can be distinguished from either of these two taxa by its annual habit (perennial in M. americanum) and herbaceous outer involucral bracts (conspicuously scarious in M. linearilobum). The leaves divided markedly into pinnatifid segments and the yellowish hue of the stems also serve as additional features to help recognize $M$. longipes from among its close relatives.

One collection, Rose 3183, from Sinaloa tends more toward a perennial habit, and the leaves are more distinctly pinnatifid. Nevertheless, these specimens appear to fall within the limits of $M$. longipes.
representative specimens. Mexico. jalisco: ca 2 mi NW of Tequila, 8 Aug 1960, King 3662 (dS, MiCh, Ny, tex, UC, US) ; Tequila, 22 Sep 1893, Pringle 4598 (F, g [2], GH, MiCH, MSC, NY, P, UC, US) ; 2 mi NW of Tequila, 3 Sep 1965, Stuessy 397 (tex), 26 Aug 1966, Stuessy 738 (tex). nayarit: El Maguey, Sierra Madre, Tepic, 26 Aug 1905, Goldsmith 132 (DS, F, GH, NY, UC, US). SINALOA: between Rosario \& Colomas, 13 Jul 1897, Rose 3183 (GH, US).
5. Melampodium linearilobum DC. Prodr. 5:518. 1836. TYPE: MEXICO: "ad Guilotepec et Las Bacas," Sep 1831, L. Alamán s.n. (Holotype, G-DC; isotype, G!; photograph of holotype, IDC 800. 927: II. 2!; photograph of G isotype, F! os! TEX! US!).

Melampolium canescens Brandg. Zoe $5: 222$. 1905. TYPE: mexico: Sinaloa, Cofradia [ca 30 mi E of Culiacán near Durango border], 22 Oct 1904, T. S. Brandegee s.n. (Lectotype chosen, UC!; isotypes, GH! POM! US!).

Annual herbs, $6-50 \mathrm{~cm}$ tall. Stems erect, $1-3 \mathrm{~mm}$ diam, strigillose-strigose with hairs 0.8 mm long. Peduncles $3.5-$ 5.5 cm long. Leaves sessile, linear and entire to markedly pinnately parted, $3-5.5 \mathrm{~cm}$ long, $0.3-3 \mathrm{~cm}$ wide, at apex acute-obtuse, at base attenuate to obtuse, with upper surface strigose with hairs $0.2-1 \mathrm{~mm}$ long, with lower surface sericeous; margin entire, at base hispid-pilose with hairs up to 2 mm long. Heads $5-7 \mathrm{~mm}$ tall, $7-11 \mathrm{~mm}$ diam. Outer
involucre cupulate, $6-10 \mathrm{~mm}$ diam; bracts 5 , slightly connate at base, imbricate $1 / 2$ their length, narrowly ovate to somewhat obovate, $3.5-5.5 \mathrm{~mm}$ long, $2.5-3 \mathrm{~mm}$ wide, at apex acute, with abaxial surface pilose-strigose with hairs 1-1.8 mm long; margin conspicuously scarious. Fruits $2-3 \mathrm{~mm}$ long, with lateral surfaces smooth and striate to tuberculate; hood apex muticous to cirrhous, with appendage up to 2.5 mm long. Ray florets $7-8$; ligules yellow-orange, ovate-orbicular (often with imbricate margins), $2-4 \mathrm{~mm}$ long, $2-5 \mathrm{~mm}$ wide. Disc florets $45-75$; corollas yelloworange, 2.4 mm diam, with throat 0.9 mm and tube 0.5 mm long. Paleae oblanceolate, 4 mm long, 1 mm wide; apex yellow, with margin entire (rarely erose) ; midrib prominent, mostly glabrous. Chromosome number, $n=10$.

Tropical deciduous and pine forests of the western Sierra Madres of Mexico and into Central America to Costa Rica (Fig. 14), 20-1620 m. Flowering dates, Jul-Oct.
The conspicuous scarious margins (colored orange-yellow when fresh) of the outer involucral bracts of $M$. linearilobum. The type of M. canescens from Sinaloa has linear, members of series Melampodium. Were it not for this characteristic bract feature, M. linearilobum would be very difficult to distinguish from $M$. longipes.

In spite of considerable vegetative variability, no intraspecific categories have been recognized within $M$. linearilobum. The type of M. canescens from Sinaloa has linear, entire leaves, as do other collections from nearby areas, but plants with similar leaves also appear in Central America and in scattered localities in Mexico. As a further indication of the plasticity of leaf shape, in many plants the upper leaves are linear and entire, while those lower on the stem are once or twice pinnatifid. Due to this vegetative plasticity, M. canescens is considered herein to be synonymous with M. linearilobum.
representative specimens. Costa Rica. guanacaste: Bolson River, 16 Jul 1918, W. \& H. Rowlee 179 (Ny, us). El Salvador. ahuachapán: 1921, Padilla 1 (US), 1921, Padilla 242 (Us), 1923,


Fig. 14. Map of Mexico and Central America showing distribution of Melampodium linearilobum.

Padilla 586 (US). MORAZÁn: ca 8 km SW of Montecristo, 3 Dec 1941, Tucker 455 (F, GH, NY, SMU, UC, US). SANTA ANA: near Chalchuapa, 1922, Calderón 979 (GH, NY, US). USULUTÁN: 24 mi E of turnoff to San Vicente on rte 1, 3 Aug 1966, Stuessy 613 (TEX). Guatemala. chiquimula: near Ipala, 23 Oct 1939, Steyermark 30309 (F). huehuetenango: between San Ildefonso Ixtahuacán \& Cuilco, 16 Aug 1942, Steyermark 50724 (F, NY). Jutiapa: between Suchitán \& Sta Catarina, Jul 1870, Bernoulli 709 (ny) ; near Jutiapa, 20 Dec 1938, Standley 60493 (F) ; between Jutiapa \& Plan de Urrutia, 28 Oct 1940, Standley 75620 (F, US) ; 8 mi NE of Jutiapa, 2 Aug 1966, Stuessy 607 (TEX). QUICHÉ: 1942, Ignacio 1495 (F). ZACAPA: near divide on rd between Zacapa \& Chiquimula, 9 Oct 1940, Standley 73774 (F) ; between Río Hondo \& Santa Cruz, 11 Oct 1940, Standley 74071 (F) ; between Río Hondo \& Santa Cruz, 11 Oct 1940, Standley 74125 (F, US) ; near La Fragua, 14 Oct 1940, Standley 74813 (F); near Sta Rosalia, 4 Oct 1939, Steyermark 29041 (F). Honduras. choluteca: vicinity of Pespire, 18-27 Oct 1950, Standley 27175 (f). Francisco morazán: El Chile, Tegucigalpa, 18 Sep 1950,

Standley 26708 (f). olancho: near Río Telica, 20 Nov 1963, Molina 13346 (F). valle: 21 Jan 1956, Molina 5899 (F). Mexico. chiapas: Chicomucelo, 14 Jul 1941, Matuda 4444 (4504) (F); valley of Jiquipilas, 16-18 Aug 1895, Nelson 2949 (GH, us). Durango?: Lodiego [ $25^{\circ} \mathrm{N}, 106^{\circ} 45^{\prime} \mathrm{W}$; McVaugh, 1956], 9-15 Oct 1891, Palmer 1609 in part (Us [2]). guerrero: Coyuca de Catalán, Pungarabato, 10 Jul 1934, Hinton et al. 6270 (F, GH, NY, US) ; Mina, Placeres, 18 Aug 1936, Hinton et al. 9113 (ARIZ, GH, TEX, US); near Iguala, 26 Apr 1900, Pringle 9162 (F, GH, NY, US) ; Los Amates Station, 28 Sep 1905, Pringle 10065 (ariz, F, G, NY, SMU, UC, US) ; ca 50 mi S of Cuernavaca, 26 Aug 1965, Stuessy 361 (tex). MÉxico: Temascaltepec, Limones, 7 Nov 1932, Hinton 2513 (GH, NY [2]) ; Temascaltepec, Palmar, 9 Aug 1934, Hinton et al. 6420 (NY, US) ; San Antonio, Tlatlaya, 20 Jul 1954, Matuda et al. 31141 (Us) ; Palmar Chico, Amatepec, 24-25 Aug 1954, Matuda et al. 31314 (US). michoacán: Zitacuaro, Zitacuaro-Tiamaro, 9 Sep 1938, Hinton et al. 13214 (ARIZ, GH, TEX, US) ; Tancitaro, above Apatzingán, 13 Aug 1941, Leavenworth \& Hoogstraal 1480 (F, GH, NY); Apatzingán, below Acahuato, 15 Aug 1941, Leavenworth \& Hoogstraal 1588 (F) ; 1 mi N of Apatzingán, 21 Aug 1966, Stuessy 697 (TEX); 4 mi N of Nueva Italia, 21 Aug 1966, Stuessy 698 (os, tex). oaxaca: Salina Cruz, 23 Aug 1935, Fisher 35321 (ariz, f, Ny, SMU, US); ca 37 mi W of Tehuantepec, 23 Jul 1960, King 3454 (DS, Ny, TEx, Uc, US) ; ca 3 mi NE of Huajuapán de León, 28 Jul 1960, King 3539 (TEX) ; Playa de Puerto Ángel, Oct 1917, Reko 3812 (US); 24 mi S of Sola de Vega, 13 Aug 1966, Stuessy 650 (tex). sinaloa: Cerro Colorado, near Cofradia, 2 Nov 1904, Brandegee s.n. (GH, UC); Cofradia, 25 Nov 1939, Gentry 5039 (ariz, GH, NY); Las Mesas, Sierra Surotato, 25 Aug 1941, Gentry 6153 (ariz, GH, NY) ; La Noria, 10 Oct 1925, Mexia 240 (UC), 14 Oct 1925, Mexia 349 (POM, UC, US). Nicaragua. granada: 1 mi S of Granada, 6 Aug 1966, Stuessy 619 (TEX).
2. Series Leucantha Stuessy, ser. nov.

Plantae perennes suffruticosae; folia anguste ovata vel lineata, saepe lobata, subtus strigosa; ligulae eburneae, plus quam vel raro circa 2 mm longae; involucrum extimum marginibus herbaceis; fructi cucullati. Species 6-8. Typus: Melampodium leucanthum Torr. \& A. Gray.
6. Melampodium leucanthum Torr. \& A. Gray, Fl. N. Amer. $2(2): 271.1842$. TYPE: TEXAS: without locality or date, J. L. Riddell s.n. (Holotype, NY?). Type not located, but the following collection cited by Gray (1852) clearly is repre-
sentative: "Hills near El Paso," Apr 1849, C. Wright 311 (GH! UC! US!).

Perennial subshrubs, $15-60 \mathrm{~cm}$ tall. Stems ascending, 1.12.5 mm diam, strigillose (rarely hispid) with hairs 0.1-0.2 mm long. Peduncles $3-7 \mathrm{~cm}$ long. Leaves sessile, linearoblong, 2.1-4.5 cm long, $0.13-1 \mathrm{~cm}$ wide, at apex and base obtuse, with both surfaces strigillose with hairs $1-2 \mathrm{~mm}$ long; margin entire to pinnately 6 -lobed, at base strigillose with hairs $0.1-0.2 \mathrm{~mm}$ long. Heads $6-8 \mathrm{~mm}$ tall, $20-37 \mathrm{~mm}$ diam. Outer involucre cupulate, $10-13 \mathrm{~mm}$ diam ; bracts 5 , connate $1 / 2$ to $3 / 4$ their length, ovate, $5-7 \mathrm{~mm}$ long, $4-5.1$ mm wide, at apex acute, with abaxial surface strigillosestrigose with hairs $0.1-0.7 \mathrm{~mm}$ long; margin herbaceous. Fruits $1.5-2.6 \mathrm{~mm}$ long, with lateral surfaces aculeate-verrucate; hood apex muticous (very rarely mucronate). Ray florets 8-13; ligules cream-white, oblong-elliptic, $7-13 \mathrm{~mm}$ long, $2.5-8 \mathrm{~mm}$ wide. Disc florets $25-50$; corollas yellow, 1 mm diam, with throat 1.2 mm and tube 0.8 mm long. Paleae oblong-elliptic, 2.9 mm long, 1.1 mm wide; apex yellow, with margin laciniate; midrib prominent, often strigillose with hairs 0.1 mm long. Chromosome numbers, $n=10$ and 20 .

Calcareous soils throughout western and central Texas (stopping at the Edward's Plateau), Arizona, New Mexico, and portions of Oklahoma, Kansas, Colorado, and northern Mexico (Fig. 15), 490-2590 m. Flowering dates, Apr-Sep.

This species is the familiar "blackfoot daisy" of the southwestern United States that has been gathered extensively by many different collectors. Despite its abundance, however, the relationships to $M$. cinereum and $M$. argophyllum have been unclear for many years. Recent studies have shown (Stuessy, 1971c ; present treatment) that M. leucanthum has a separate distribution that comes only within ten miles of $M$. cinereum at the edge of the Edward's Plateau.

Both $2 n$ and $4 n$ cytological races have been reported for this species (Turner and King, 1962; Stuessy, 1971b \& c),


Fig. 15. Map of the southwestern United States and adjacent Mexico showing distribution of Melampodium leucanthum.
and they are morphologically indistinguishable. Evidence for treating these cytotypes as informal races having been derived by spontaneous autopolyploidy has been reviewed by Stuessy (1971c).
representative specimens. Mexico. chihuahua: 7 mi N of Mesteñas, 25 Sep 1938, Johnstón 7959 (GH, us) ; Organos Mts, 8 Sep 1937, LeSueur 1456 (f, tex) ; Colonia Díaz, 20-21 Sep 1899, Nelson 6447 (GH, US) ; hills near Chihuahua, 5 Oct 1886, Pringle 1019 (F, ny, US) ; 20 mi S of Ciudad Júarez, 21 Jul 1937, Shreve 7918 (ariz, GH, US) ; 59 mi N of Villa Ahumada, 23 Aug 1967, Stuessy 1122 (tex). Coahuila: Del Carmen Míts, 6 Sep 1936, Marsh 855 ( $F$, GH, TEX) ; Cañon del Indio Felipe, close to the Chihuahuan boundary, 27-29 Sep 1940, Stewart 84 (GH). SONORA: Colonia Morelos, 15 Sep-4 Oct 1941, White 4587 (ariz, GH) ; 5 mi E of Esqueda on rd to Río de la Tierra, 10 May 1948, Wiggins 11765
(DS, US). UNITED STATES. Arizona: Cochise co., near Douglas, 16 Aug 1907, Goodding 2399a (DS, GH, US). GILA co., ca 3 mi N of Dripping Springs turnoff, 11 Apr 1965, Niles 572 (ariz, tex); greenlee co., 7 mi N of Metcalf, 6 Jun 1935, Maguire, Richards \& Moeller 11849 (ariz, GH, Ny) ; maricopa co., 3 mi N of Sunflower, 9 Apr 1960, Russell 11511 (Smu [2], UC); монaVe co., Kingman, 18 Apr 1935, Kearney \& Peebles 11133 (ariz, GH, US); pima co., 3 mi N of Greaterville, 17 Aug 1967, Turner 5735 (tex) ; yavapai co., 10 mi SW of Congress, 21 Apr 1962, Turner 4790 (DS, FSU, SMU, tex) ; yuma co., Squaw Canyon, Harquahala Mts, 9 Sep 1952, Wright 42-54 (ariz). Colorado: baca co., 25 mi S of Pritchett, 11 Jul 1947, Porter 4262 (GH, RSA, SMU, tex) ; EL paso co., below Colorado Springs, 29 May 1878, Jones 117 (f, pom [2]); fremont co., Canon City, 2 Jul 1920, Clokey 3946 (dS, F, GH, NY, POM, UC, US) ; PROWERS Co., 31 mi S of Lamar, 6 Jun 1967, Irving 825 (TEX); pueblo co., 12 mi S of Pueblo, 7 Jun 1922, Wiegand \& Upton 4439 (ny). Kansas: ford co., 3 mi S of Dodge City, 9 Jul 1950, Horr 3444 (GH, US) ; HAMILTON Co., vicinity of Syracuse, 15 Sep 1912, Rose \& Fitch 17043 (ny, us) ; meade co., 16 mi SE of Meade, 16 Aug 1939, Horr \& Franklin E278 (F, GH, SMU, TEX, UC, US) ; SEWARD co., Jul 1891, Carleton 331 (ariz, f, us). New Mexico: bernalillo co., ca 2 mi E of Albuquerque, 1915, Kammerer 48 (DS, TEX); chaves co., 20 mi S of Roswell, Aug 1900, F. \& E. Earle 295 (ny, POM, US) ; DE BACA CO., 6 mi E of Yeso, 8 Aug 1967, Turner 5673 (TEX) ; dONA aNA Co., Organ Mts, 9 Jul 1897, Wooton 117 (DS, GH, ny, Pom, UC, US) ; Grant co., Mangas Springs, 18 mi NE of Silver City, 15 May 1903, Metcalfe 66 (ariz, dS, NY, pOM, UC [2], US); lincoln Co., 75 mi E of Capitan, 25 Jul 1938, Hitchcock, Rethke \& van Raadshooven 4244 (dS, GH, UC) ; roosevelt co., 5 mi NE of Portales, 14 Jul 1930, Goodman \& Hitchcock 1130 (DS, GH, NY, UC) ; SAN Miguel Co., 10 mi SE of Las Vegas, 27 Jul 1924, Bacigalupi 607 (DS, GH, UC) ; SANTA FE Co., 20 mi S of Golden, 24 Jul 1938, Hitchcock, Rethke \& van Raadshooven 4214 (DS, GH, UC) ; SIERra co., Kingston, 29 Aug 1904, Metcalfe 1271 (F, GH, NY, POM, UC, US). Oklahoma: BEAVER co., near Knowles, 5 May 1913, Stevens 325 (DS, NY, Smu, US); cimarron co., Kenton, low sides of Black Mesa, 28 Jul 1936, Demaree 13344 (GH, NY, POM, SMU) ; JACKSON co., El Dorado, 18 Apr 1936, Demaree 12210 (SMU, US). Texas: andrews co., 5 mi WSW of Andrews, 15 Sep 1966, Shinners 31559 (SMU); BELL Co., $21 / 2 \mathrm{mi} \mathrm{S}$ of Nolanville, 7 Mar 1954, C. \& G. York 54037 (SMU, TEX) ; bexar co., 5 mi NW of San Antonio, 4 May 1948, Burr 135 (DS, Ny [2]); blanco co., 10 mi N of Johnson City, 18 Apr 1958, Thompson \& Graham 18 (Smu, tex) ; brewster Co., Marathon, 15 Jul 1965, Stuessy 230 (TEX); BROWN co., 7 mi S of Brownwood, 24 Apr 1966, Guthrie 43 (Smu, tex) ; callahan co., ca 2 mi W of Baird, 27 Mar

1963, Henderson 63-88 (FSU, SMU, tex) ; Coleman co., 1 mi SE of Santa Ana, 9 Jul 1957, Shinners 26390 (SMU) ; COMAL co., Comanche Spring, Mar 1849, Lindheimer 949 (ariz, F, GH, Ny, TEX, UC, US); comanche co., 7 mi W of Comanche, 6 Apr 1966, Teeters 18 (Ll, SMU, TEX) ; CORyELL Co., 4 mi S of Gatesville, 2 Oct 1965, Baize 5 (Ll, SMU, TEX) ; CROCKEtt co., 31 mi W of Ozona, 8 Jul 1965, Stuessy 147 (tex) ; culberson co., 1 mi S of Texas-New Mexico line E of Guadalupe Mts, 14 Aug 1942, Waterfall 3781 (ARIZ, GH, NY) ; DAWSON co., plains between Lamesa \& Tahoka, 29 Apr 1925, Small \& Wherry 12134 (ny, tex) ; Ector co., 5.8 mi S of Odessa, 8 May 1966, Shinners 31236 (SMU) ; EL PASO co., 28 mi SE of El Paso, 24 Aug 1967, Stuessy 1127 (tex) ; erath co., Stephenville Pk, 9 mi N of Stephenville, 2 Apr 1950, Shinners 12190 (SMu) ; Floyd co., intersection of hwys $97 \& 2009,22$ Apr 1962, Melchert 180 (TEx); gilLespie co., 4.8 mi NE of Lawrence Jung Ranch, 31 Mar 1967, Mears 1383 (TEX) ; hamilton co., 17 mi S of Hico, 16 Apr 1945, Shinners 7183 (GH, LL, SMU, UC) ; hardeman co., 11 mi S of Quanah, 4 Apr 1966, Turner 7 (Ll, tex) ; hays co., 1.5 mi E of Dripping Springs, 30 May 1966, Stuessy 414 (TEX) ; HEMPHill co., 18 mi SW of Canadian, 15 Sep 1950, Tharp \& Miller 51-312 (RSA, TEX); hudspeth co., ca 20 mi N of Allamore, 29 Jul 1943, Waterfall 4818 (GH, NY, SMU) ; JEFF davis co., gravel flat between Big \& Little Aguja Canyons, Davis Mts, 16 Jun 1931, Moore \& Steyermark 3115 (dS, GH, NY, UC, US) ; Kendall co., 5 mi W of Sisterdale, 24 May 1965, Flyr 489 (DS, SMU) ; KERr Co., Kerrville, 19-25 Apr 1894, Heller 1632 (ariz, F, GH, Ny [2], pom, SMU, Uc [2], US) ; KNox co., 5 mi E of Benjamin, 22 Apr 1962, Melchert 169-C (TEX); Llano co., Marble, 31 Mar 1967, Mears 1413 (tex); loving co., 1 mi W of Mentone, 10 Jul 1965, Stuessy 180 (tex) ; Lubbock Co., Lubbock, 4 May 1930, Demaree 7594 (DS, GH, US) ; NOLAN co., Sweetwater, 5 May 1927, Stanfield s.n. (ny, tex) ; ochiltree co., 7.8 mi SE of Perryton, 13 Jul 1957, Wallis 4807 (ARIZ, SMU) ; OLDHAM Co., 16 mi N of Vega, 17 May 1967, Turner 5632 (tex); pecos co., 10 mi E of Ft. Stockton, 19 Apr 1946, Warnock 46217 (FSU, TEX) ; POTTER co., 1 mi N of Canadian River Bridge, 19 May 1945, Jespersen 2678 (DS, F, NY, SMU, UC, US) ; PRESidio Co., 7.5 mi N of Candelaria, 17 Apr 1947, McVaugh 7986 (DS, F, LL [2], SMU, tex [2]) ; Randall co., Palo Duro State Pk, 20 Oct 1945, Cory 50422 (GH, NY, SMu); shackelford co., 2 mi NE of Jones Co. line, 27 Mar 1963, Henderson 63-93 (SMU, TEX) ; STEPhENS Co., 3 mi N of Ranger, 29 Apr 1939, Culwell \& Timmons 3091 (Smu, tex) ; taylor co., 5 mi SW of Abilene, 30 Jun 1962, Turner \& Melchert 4840 (tEX); TRAvis co., 7 mi SW of Zilker Pk, Austin, 13 Oct 1966, Stuessy 752 (os, TEx); uvalde co., Garner State Pk, 21 Jun 1958, Sullivan \& Turner 34 (FSU, TEX) ; VAL VERDE CO., 13 mi W of Langtry, 23 Mar 1941,

Innes \& Warnock 589 (DS, GH, NY, TEX) ; WARD CO., Barstow, 15 Apr 1902, Tracy \& Earle 23 (F, GH, Ny [2], TEX, US), Wilbarger co., 16.9 mi S of Electra-Waggoner pastures, 12 May 1945, Whitehouse 9841 (SMU, TEX) ; WINKLER CO., 1 mi W of Kermit, 10 Jul 1965, Stuessy 167 (TEX).
7. Melampodium cinereum DC. Prodr. 5:518. 1836.

Perennial subshrubs, $14-20 \mathrm{~cm}$ tall. Stems suffruticose, ascending. Leaves sessile, at apex and base obtuse, at margin revolute when dry. Outer involucre cupulate; bracts 5 , connate $1 / 6$ to $1 / 3$ their length, ovate, at apex acute, with abaxial surface strigose with hairs $0.2-1 \mathrm{~mm}$ long, at margin herbaceous. Fruits with lateral surfaces aculeate-verrucate. Ligules cream-white, oblong-elliptic. Disc corollas yellow. Paleae oblong-oblanceolate; apex yellow, with margin laciniate; midrib prominent, glabrous or puberulous with hairs 0.1 mm long.

7a. Melampodium cinereum DC. var. cinereum
Melampodium cinereum DC. Prodr. 5:518. 1836. TYPE: mexico [?]: San Fernando de las Presas, Oct 1830, J. L. Berlandier 2243 [ $=823$ ] (Holotype, G-DC; isotypes, G! GH! K!; photograph of holotype, IDC 800. 927: II. 4!; photograph of K isotype, B! US!; photograph of G isotype, F! US!). San Fernando is a town about 83 miles SW of Matamoros, Tamaulipas, Mexico, an area visited by Berlandier (Geiser, 1948). However, this variety is known to occur only near Laredo and the surrounding territory in southcentral Texas, indicating that the locality may have been interchanged with M. ramosissimum as suggested by Gray (1884) and Robinson (1901).

Stems $0.8-1.3 \mathrm{~mm}$ diam, strigose with hairs $0.1-0.8 \mathrm{~mm}$ long. Peduncles 1.5-7 cm long. Leaves linear-oblong, 1.25.5 cm long, $0.12-1.4 \mathrm{~cm}$ wide, with both leaf surfaces strigose with hairs $0.2-0.6 \mathrm{~mm}$ long; margin entire to pinnately 10 -lobed or parted, near base strigose with hairs up to 0.6 mm long. Heads $5-8 \mathrm{~mm}$ tall, $9-23 \mathrm{~mm}$ diam. Outer involucre $7-13 \mathrm{~mm}$ diam; bracts $3.5-7.3 \mathrm{~mm}$ long, 2.3-5 mm wide. Fruits $1.4-2.2 \mathrm{~mm}$ long; hood apex muti-


Fig. 16. Map of southern Texas and adjacent Mexico showing distribution of Melampodium cinereum var. cinereum, small form (circles), large form (dots); M. cinereum var. hirtellum (open squares) ; M. cinereum var. ramosissimum (closed squares); and M. argophyllum (triangles). Shaded area indicates generalized southeastern distribution of $M$. leucanthum.
cous to cirrhous, with appendage up to 2.2 mm long. Ray florets $7-13$; ligules $3-8.2 \mathrm{~mm}$ long, $1-3.6 \mathrm{~mm}$ wide. Disc florets $30-50$; corollas 1.1 mm diam, with throat 0.8 mm and tube 0.7 mm long. Paleae 2.5 mm long, 1.1 mm wide. Chromosome numbers, $n=10$ and 20 .

Mesquite-grasslands of Rio Grande Plains of Texas south to Cameron Co., east to Jim Wells Co., north to Bexar Co. and west to Maverick Co., extending into Tamaulipas and Nuevo León, Mexico, 30-240 m (Fig. 16). Flowering dates, Mar-Nov.

All the varieties of $M$. cinereum can be distinguished most easily from $M$. leucanthum and $M$. argophyllum by the outer phyllaries that are connate only $1 / 4$ their length at the base. The outer involucral bracts of the latter two species always are fused at least $1 / 2$ or even $2 / 3$ their length. The usefulness of this feature has not been previously noted, but it is the best diagnostic morphological character that I have discovered for separating $M$. cinereum from the other taxa of the white-rayed complex.

Scattered within the range of var. cinereum are two morphological forms (small and large) that are weakly differentiated by quantitative features of habit and head size. These informal units presumably correspond to the $2 n$ and $4 n$ autopolyploid chromosomal races reported within this variety by Turner and King (1962) and Stuessy (1971b $\& \mathrm{c})$. Additional information concerning the presumptive autopolyploid origin of these races can be found in Stuessy (1971c).

[^7]Rio Grande City, 9 Oct 1954, Tharp \& Johnston 541922 (TEX); webb co., 22 mi NW of jct rtes $83 \& 35$, 5 Jul 1967, Stuessy 868 (tex) ; zapata co., 13 mi N of San Ygnacio, 31 Jan 1954, Shinners 17659 (SMU) ; zavala co., 6 mi S of Batesville, 6 May 1964, Turner 5006 (SMU, TEX).
representative specimens (Large Form). Mexico: tamauLipas: 3 mi S of Nuevo Laredo, 11 Nov 1961, Escalante 21 (TEX); 50 mi SE of Nuevo Laredo, 28 Mar 1964, A. \& R. García 47 (ariz, Smu, tex) ; 12 mi SE of Nuevo Laredo, 17 Mar 1962, C. \& L. de la Garza 46 (Smu, tex). UNITED States. Texas: bexar co., Highland Hills, San Antonio, 1 Apr 1963, Martínez \& García 13 (Smu) ; brooks co., 15 mi E of Hebbronville, 17 Mar 1963, Ramírez 44 (Ll, tex) ; Cameron co., 12 mi N of Brownsville, 18 Apr 1965, Ríos \& Cavazos 264 (Ll, SMu) ; duval co., 25 mi N of Hebbronville, 20 Jun 1966, Stuessy 429 (TEX) ; FRIo co., 9 mi S of Moore, 20 Nov 1967, Stuessy \& Renold 1284 (tex) ; hidalgo co., 1 mi E of Sullivan City, 1 Apr 1941, C. \& A. Lundell 9866 (Ll [3], RSA) ; JIM hoGG Co., 5 mi E of Hebbronville, 20 Jun 1966, Stuessy 425 (tex) ; jim wells co., 2 mi E of San Diego, 25 Nov 1962, Dohnke 3 (Smu, tex) ; kinney co., [?], Bracket [Brackettville?], 21 Mar 1900, Canby 133 (us); la Salle co., 1 mi N of Encinal, 16 Mar 1963, Solis 124 (Smu, tex) ; LIVE oak co., ca 32 mi S of Whitsett, 3 Jun 1967, Stuessy 771 (TEX); mcmullen co., $22 \frac{1}{2} \mathrm{mi}$ SW of George West, 17 Apr 1965 , Rios \& Cavazos 231 (ll, Smu); medina co., ca 3 mi S of Devine, 28 Oct 1952, Correll 15204 (Ll, US) ; Nueces Co., ca 4 mi W of Mathis, 8 May 1957, Jones 1359 (Smu) ; starr co., 3 mi N of Roma, 31 Jan 1954, Shinners 17708 (Smu) ; uvalde co., Leona River, 7 mi SE of Uvalde, 23 Jun 1935, Munz 13303 (ром); webb co., 14 mi NE of Laredo, 9 Mar 1963, Cisneros 33 (Ll) ; zapata co., 10 mi N of San Ygnacio, 7 Apr 1963, Arzola 178 (LL, SMU).
7b. Melampodium cinereum DC. var. hirtellum Stuessy, Sida $3: 348$. 1969. TYPE: MEXICO: Nuevo León, 5 km S of Sabinas Hidalgo on rd to Monterrey, 21 Apr 1939, T. C. \& E. M. Frye 2415 (Holotype, US!; isotypes, DS! GH! NY! RSA! UC!).

Stems 0.8-1.3 diam, strigose-hispid with hairs 0.2-1.5 mm long. Peduncles $0.7-8 \mathrm{~cm}$ long. Leaves linear-oblong, $1.1-3.4 \mathrm{~cm}$ long, $0.2-1 \mathrm{~cm}$ wide, with both surfaces strigose with hairs $0.3-0.8 \mathrm{~mm}$ long, with midrib on undersurface hispid with hairs up to 1.5 mm long; margin pinnately 8 lobed or parted, near base hispid with hairs $0.4-1.5 \mathrm{~mm}$ long. Heads $4.5-5 \mathrm{~mm}$ tall, $9-18 \mathrm{~mm}$ diam. Outer involucre $7-10 \mathrm{~mm}$ diam; bracts $3.3-6 \mathrm{~mm}$ long, $2.2-3.6 \mathrm{~mm}$ wide.

Fruits $1.3-2 \mathrm{~mm}$ long; hood apex muticous to mucronate, with appendage up to 0.3 mm long. Ray florets $8-13$; ligules $3-6 \mathrm{~mm}$ long, $1.3-2.8 \mathrm{~mm}$ wide. Disc florets $25-50$; corollas 1.1 mm diam, with throat 0.7 mm and tube 0.5 mm long. Paleae 3.2 mm long, 0.9 mm wide. Chromosome number, $n=10$.

Mesquite-grasslands in eastern Coahuila, northwestern Nuevo León and Tamaulipas, Mexico, and into Val Verde, Kinney, Uvalde and Maverick Cos. of Texas (Fig. 16), $210-520 \mathrm{~m}$. Flowering dates, Feb-Oct.
representative specimens. Mexico: coahulla: Saltillo, Aug 1913, Adole 29 (F, GH, NY, US); Sabinas, 16 Sep 1937, Kenoyer 5 (F) ; 30 mi S of Monclova, 14 Aug 1948, Kenoyer \& Crum 2594 (A); Muzquiz, Apr 1938, Marsh 1176 (F, GH, TEX) ; Soledad, 25 mi SW from Monclova, 9-19 Sep 1880, Palmer 556 (GH, NY, US); Rio Grande Valley near Diaz, 17 Apr 1900, Pringle 9008 (F, GH, US); 4 mi W of Nueva Rosita, 14 Aug 1967, Stuessy 902 (TEX) ; 21 mi S of Monclova on rte 57, 14 Aug 1967, Stuessy 912 (tex); 23 mi N of Sabinas, 23 Aug 1959, Waterfall 15805 (F, SMU); Monclova, 25 mi SW of Sabinas, 19 Jun 1936, Wynd \& Muller 214 (ARIZ, FSU, GH, NY, US). NUEvo LEÓN: Monterrey, Obispado, Jul 1911, Abloon 137 (US) ; 36 mi NE of Sabinas Hidalgo, 24 Mar 1944, Barkley 14575C (GH, NY) ; between Laredo \& Monterrey, 8 Feb 1945, Bonner 55 (F) ; 12 mi N of Sabinas Hidalgo, 26 Mar 1944, Heard \& Barkley 14542B (TEX) ; Cerro del Obispado, 20 Oct 1946, Lacás 58 (F) ; 8 mi S of Sabinas Hidalgo, 8 Feb 1964, May 13 (SMU); $12 \mathrm{mi} W$ of Monterrey, 27 Feb 1944, Painter, Lucas \& Barkley 14297 (TEx); 47 mi S of Nuevo Laredo, 28 Apr 1962, Reséndez 52 (SMU, TEx) ; 17 mi NE of Sabinas [Hidalgo], 20 Mar 1963, Rodríguez 72 (SMU); 26 mi N of Sabinas Hidalgo, 12 Jun 1967, Stuessy 855 (TEX); 38 mi N of Sabinas Hidalgo, 12 Jun 1967, Stuessy 856 (tex). UNITED STATES. Texas: Kinney co., 9 mi W of Brackettville, 28 Mar 1947, McVaugh 7694 (DS, F, LL [2], SMU, TEX) ; MAVERICK co., 30 mi SE of Eagle Pass, 14 Mar 1964, Bruni 15 (Ll, SMU, tex) ; uvalde co., 2 mi N of Cline, 8 Jul 1936, Hedrick 156 (UC); val verde co., Del Rio, 20 Apr 1930, Jones 25916 (DS, POM).
7c. Melampodium cinereum DC. var. ramosissimum (DC.) A. Gray, Smithson. Contrib. Knowledge 3, Art. 5: 103. 1850.

Melampodium ramosissimum DC. Prodr. 5:518. 1836. TYPE: TEXAS[?]: between the Nueces River \& Laredo,

Jul 1829, J. L. Berlandier 2017 [=607] (Holotype, G-DC; isotypes, F ! G! GH[2]! HAL! K! MO[2]! W[2]! WIS!; photograph of holotype, IDC 800. 927: II. 1!; photograph of K isotype, US!; photograph of HAL isotype, os! TEX!).

Melampodium cinerascens S. F. Blake, Contrib. U. S. Nat. Herb. 22:605. 1924. TYPE: mexico: Tamaulipas, Hacienda Buena Vista, ca 20 mi E of Abasolo, 18 Jun 1919, E. O. Wooton s.n. (Holotype, US ! ; photograph of holotype, TEX!).

Stems $0.7-0.8 \mathrm{~mm}$ diam, strigose with hairs $0.1-0.8 \mathrm{~mm}$ long. Peduncles $0.7-3.8 \mathrm{~cm}$ long. Leaves linear, $0.7-3.2 \mathrm{~cm}$ long, $0.2-0.5 \mathrm{~cm}$ wide, with both leaf surfaces strigose with hairs $0.2-1 \mathrm{~mm}$ long; margin entire to pinnately 10 -lobed or cleft, near base strigose with hairs up to 1 mm long. Heads $3-5 \mathrm{~mm}$ tall, $5-14 \mathrm{~mm}$ diam. Outer involucre $4.5-9$ mm diam; bracts $2.7-4 \mathrm{~mm}$ long, $1.3-2.8 \mathrm{~mm}$ wide. Fruits 1.5-1.7 mm long; hood apex mucronate to cirrhous (rarely muticous), with appendage up to 1.5 mm long. Ray florets 7-8; ligules $2-3.8 \mathrm{~mm}$ long, $1-2.3 \mathrm{~mm}$ wide. Disc florets 25-35; corollas 1.3 mm diam, with throat and tube each 0.4 mm long. Paleae 2.5 mm long, 0.9 mm wide. Chromosome number, $n=10$.

Mesquite-grasslands of northern Tamaulipas, Mexico, and adjacent Hidalgo, Cameron and Webb Cos. of Texas (Fig. 16), 15-90 m. Flowering dates, Jun-Dec.

There is some character intergradation where the three varieties of $M$. cinereum overlap near the Rio Grande Valley of southern Texas (Fig. 16). Although no detailed studies have been carried out to clarify the nature of this intergradation, hybridization is likely to be occurring.

[^8]Stuessy 787 (TEX); 3 mi S of San Fernando, 18 Nov 1967, Stuessy \& Renold 1261 (TEx). UNITED STATES. Texas: hidalgo co., Mission, Lomita Alta, 13 Jul 1937, Cameron 248 in part (tex); McAllen, 10 Aug 1937, Cameron 248 in part (TEX) ; La Joya gravel pit, 27 Aug 1942, Walker 93 (Ll, tex); Webb Co., 11 mi W of Encinal, 5 Jul 1960, H. \& F. Iltis \& Koeppen 35 (wis).
8. Melampodium argophyllum (A. Gray ex Robins.) S. F. Blake, Contrib. U. S. Nat. Herb. $22: 606.1924$.

Melampodium cinereum DC. var. argophyllum A. Gray ex Robins. Proc. Amer. Acad. Arts \& Sci. 36:458. 1901. (A. Gray in S. Wats. Proc. Amer. Acad. Arts \& Sci. 18: 104. 1883. nom nud., but based on the type collection) TYPE: MEXICO: Coahuila Sierra Madre S of Saltillo [ca 60 km SE of Saltillo; McVaugh, 1956], Feb-Oct 1880, E. Palmer 2068 (Holotype, GH!).

Melampodium leucanthum Torr. \& A. Gray var. argophyllum (A. Gray ex Robins.) Stuessy, Sida 3:348. 1969.

Perennial subshrubs, $12-22 \mathrm{~cm}$ tall. Stems ascending, 0.81.2 mm diam, canescent-tomentose with hairs $0.2-1 \mathrm{~mm}$ long. Peduncles $3.5-7.7 \mathrm{~cm}$ long. Leaves sessile, linear-oblong, 1-2.8 cm long, $0.2-1.5 \mathrm{~cm}$ wide, at apex and base obtuse, with both surfaces tomentose with hairs $0.2-1 \mathrm{~mm}$ long; margin pinnately 8 -lobed or parted (rarely entire), near base strigose-hispid with hairs $0.5-0.7 \mathrm{~mm}$ long. Heads $4-7 \mathrm{~mm}$ tall, $10-23 \mathrm{~mm}$ diam. Outer involucre cupulate, 6.2-12 mm diam; bracts 5 , connate $1 / 2$ to $3 / 5$ their length, ovate, $3.5-6 \mathrm{~mm}$ long, $2.5-5 \mathrm{~mm}$ wide, at apex acute, with abaxial surface tomentose with hairs $0.1-1 \mathrm{~mm}$ long; margin herbaceous. Fruits $0.8-1.9 \mathrm{~mm}$ long, with lateral surfaces aculeate-verrucate; hood apex muticous to cirrhous (usually mucronate). Ray florets 8-9; ligules cream-white, oblong-elliptic, 2.5-9 mm long, 1.5-4.5 mm wide. Disc florets 25-50; corollas yellow, 1 mm diam, throat and tube each 0.8 mm long. Paleae oblong-elliptic, 2.6 mm long, 1.2 mm wide; apex yellow, with margin laciniate; midrib prominent, often strigillose with hairs 0.1 mm long. Chromosome number unknown.

Arid mountains in western Nuevo León and adjacent Coahuila, Mexico (Fig. 16), 1830-2440 m. Flowering dates, Feb-Oct.

Although M. argophyllum was first described as a variety of $M$. cinereum, in subsequent years the status of the former taxon has been changed twice. Morphologically $M$. argophyllum shows similarity to both $M$. leucanthum and $M$. cinereum but seems to have a greater total resemblance to the former species. Due to recent chromatographic studies on M. argophyllum and other taxa of the white-rayed complex (Stuessy, 1971c), however, I have reversed my earlier judgment (1969a) based solely on morphological criteria which treated $M$. argophyllum as a variety of $M$. leucanthum. I now concur with Blake's (1924) recognition of M. argophyllum as being a distinct species. Refer to my recent paper (1971c) for additional discussions on the status of $M$. argophyllum and on hypothetical evolutionary relationships within the entire white-rayed complex.
representative specimens. Mexico. Coahuila: G. Cepeda, Sierra de la Paila (V. Seco), 6 Jul 1944, Hinton et al. 16563 (GH, NY, Us) ; 45 km SW of Monterrey, 28 Feb 1946, Johnson \& Barkley 16250M (TEX) ; Castaños, "Puerto de San Lázaro," Sierra de San Lazar, 30 Aug 1939, Muller 3040 (F, GH, UC) ; Sierra de la Pata Solana, Mar 1905, Purpus 1003 (F, GH, NY, UC), Feb 1905, Purpus 1003a (UC) ; Sierra de la Paila, Oct 1910, Purpus 4730 (UC); Sierra de Parras, Mar 1905, Purpus s.n. (UC) ; Cañon Espantosa, W slope of Sierra de San Vicente, ca 20 km ESE of Cuatro Cienegas, 25 Mar 1941, Schroeder 120 (GH) ; 9 km S of Parras on Sierras Negras, 3 Jul 1941, Stanford, Retherford \& Northcraft 186 (ARIZ, DS, F, GH, NY [2], UC) ; Castaños, San Lázaro, "rocky slopes of El Puerto de San Lázaro," 16 Jun 1936, Wynd \& Muller 132 (ARIZ, US). NUEvo LEÓN: Las Salinas, 1924, Orcutt 1395 (US) ; 24 km W of Icamole, 3 Feb 1907, Safford 1264 (US).

## 3. Series Sericea Stuessy, ser. nov.

Herbae annuae; folia lanceolata vel pinnatim divisa, subtus sericea vel strigosa; ligulae luteae, minus quam vel raro circa 2 mm longae; involucrum extimum marginibus herbaceis; fructi plerumque cucullati. Species 9-13. Typus: Melampodium sericeum Lag.
9. Melampodium sericeum Lag. Gen. et Sp. Nov. 32. 1816. non H.B.K. 1820. TYPE: "NOVA HISPANIA": 1787-1804, seeds collected by M. Sessé \& J. M. Mociño s.n. (Holotype, MA? ; isotype, G ! ; photograph of G isotype, F ! OS! TEX! US!; photograph of G-DC isotype, IDC 800. 937: I. 8!).

Melampodium hispidum H.B.K. Nov. Gen. Sp. 4:273. $t$. 399. 1820. TYPE: MEXICO: Michoacán, between Pázcuaro \& Valladolid [Morelia], 6000 ft , Sep 1803, F. H. A. von Humboldt \& A. J. Bonpland s.n. (Holotype, P; fragments of holotype, P!).

Melampodium sericeum Lag. var. brevipes A. Gray, Proc. Amer. Acad. Arts \& Sci. 22: 423. 1887. TYpe: mexico: Guanajuato, León, W of Guanajuato, 1829, "Menzies" [probably J. Méndez] s.n. (Holotype, GH!; photograph of G-DC isotype, TEX!; tracing of probable isotype [G?], GH!).

Melampodium sericeum Lag. var. exappendiculatum Robins. Proc. Amer. Acad. Arts \& Sci. 36:459. 1901. TYPE: mexico: San Luis Potosí, "in mountains near Morales," Aug 1876, J. G. Schaffner 271 (Lectotype chosen, GH!).

Annual herbs, $3-40 \mathrm{~cm}$ tall. Stems ascending to erect, $0.4-2.5 \mathrm{~mm}$ diam, hispid-pilose with hairs up to 1 mm long. Peduncles 5-22 mm long. Leaves sessile, linear-oblong to oblanceolate, $2-6.5 \mathrm{~cm}$ long, $0.2-3 \mathrm{~cm}$ wide, at apex acuteobtuse, at base attenuate to obtuse, with upper surface strigose with hairs 0.5 mm long, with lower surface sericeous; margin entire to pinnately parted with 1-4 lobes, irregularly ciliate with hairs 0.2 mm long, at base hispid with hairs 1-1.5 mm long. Heads $4-5 \mathrm{~mm}$ tall, $4-8 \mathrm{~mm}$ diam. Outer involucre cupulate, $6-11 \mathrm{~mm}$ diam; bracts 5 , slightly connate at base, separate to imbricate, narrowly rhombic to obovate, $3-7 \mathrm{~mm}$ long, $2-4 \mathrm{~mm}$ wide, at apex acute, with abaxial surface pilose to hispid with hairs 1-1.5 mm long; margin herbaceous. Fruits $2.5-3.2 \mathrm{~mm}$ long, with lateral surfaces smooth and striate to strongly verrucate; hood apex muticous to cirrhous, with tapering appendage up to 2 mm long. Ray florets 5-7; ligules yellow, narrowly ovate, 0.8-1.2(2.2) mm long, 0.6-0.8(-1.2) mm wide. Disc florets Cruz, Sep 1851, G. Thurber 937 (Lectotype, GH! K! mo!


Fig. 17. Map of Mexico and adjacent Central America showing distribution of Melampodium sericeum.
(-5) 8-12; corollas yellow, 1.1 mm diam, with throat 0.6 mm and tube 0.5 mm long. Paleae oblanceolate, 3.5 mm long, 0.3 mm wide; apex yellow, with margin dentate-erose; midrib prominent, glabrous. Chromosome number, $n=30$.

Pine-oak forests of Mexico, Guatemala and El Salvador (Fig. 17), 1100-2590 m. Flowering dates, Jul-Sep.

This is a widespread, variable species. Although no varieties are recognized here in $M$. sericeum, there are several morphologically distinct collections that should be noted. One specimen from Guatemala, Steyermark 50530, is unusually robust and has brown-purple disc florets. Also from Guatemala are several collections, Morales 1300, Rojas 86, Standley 59769 and 82849, which possess fruits with
broad, wide-spreading hoods in contrast to the much narrower hoods typical of the species.
representative specimens. El Salvador. Santa ana: near Chalchuapa, 1922, Calderón 1019 (GH, US). Guatemala. baja verapaz: Santa Rosa, Oct 1912, Tuerckheim 3955 (US). ESCUINTLA: 1942, Ignacio 1567 (F). GUATEMala: Laguna, Amatitlán, 1929, Morales 1300 (F) ; Chilloni, 21 Jun 1921, Rojas 86 (GH, NY, US); Finca Bretaña, rd between Guatemala \& Riscal, 12 Dec 1938, Standley 59769 ( $\mathrm{F}, \mathrm{Ny}$, Smu). huehuetenango: ca 3 mi S of Huehuetenango, 18 Jul 1960, King 3416 (ny, tex, UC) ; Huehuetenango, 9 Nov 1934, Skutch 1592 (GH); between San Sebastián H. \& Río San Juan, 9 Jan 1941, Standley 82849 (F, NY, US) ; between Huehuetenango \& San Sebastián H., 12 Aug 1942, Steyermark 50392 (F, GH, US); between San Sebastián H. \& San Rafael Pétzal, 14 Aug 1942, Steyermark 50530 (F). Quiché: 1942, Ignacio 1404 (F). Mexico. chinuahua: La Mesa Colorada, 14 Oct 1939, Gentry 550 [550M] (ariz, dS, F) ; Loreto, Río Mayo, 1 Sep 1936, Gentry 2553 (ariz, GH, F, UC, US) ; Temosachic, Cañón Huahuatán, 10 mi SE of Madera, 23 Sep 1939, Muller 3434 (GH, UC). Colima: Alzada, 25 Aug 1966, Stuessy 730 (TEX). distrito federal: Olivar, 15 Aug 1910, Orcutt 3605 (F) ; above Santa Fe, 4 Sep 1901, Pringle 8609 in part (F, GH, ny, pom, uc, us [2]). durango: vicinity of Durango, Iron Mt, Oct 1896, Palmer 926 (GH, us). guanajuato: 20 mi NE of Irapuato, 28 Aug 1947, Barkley, Rowell \& Paxson 735 (TEX) ; near Guanajuato, Sep [year?], Dugès 44 (GH [2]); Guanajuato, 1909, Furness s.n. (F) ; near Acambaro, 6 Oct 1892, Pringle 5309 (GH); 14 mi SE of León, 16 Aug 1957, Waterfall \& Wallis 13886 (F, SMU). GUERrero: Petaquillas, 27 Aug 1965, Stuessy 364 (TEX). JALISCO: 56 mi SE of Guadalajara, 21 Aug 1953, W. \& M. Manning 531212 (GH, TEX); ca 11 mi SE of Lagos de Moreno, 7 Sep 1952, McVaugh 12822 (SMU, US) ; Guadalajara, Jul 1886, Palmer 260 (GH, US) ; near Guadalajara, 24 Aug 1901, Rose \& Hay 6275 (GH, US); 2 mi NW of Tequila, 26 Aug 1966, Stuessy 740 (TEX). MÉxico: Temascaltepec, Plaza de Gallos, 22 Jul 1934, Hinton et al. 6324 (GH, NY, US). michoacán: ca 10 mi W of Morelia, 5 Aug 1960, King 3626 (DS, ny, tex, uc, us); Cerro Potrerillos, ca 5 mi N of Cotija, 5-9 Oct 1961, King \& Soderstrom 4584 (NY, SMU, TEX, UC, US) ; 0.8 mi NW of Zitacuaro, 1 Sep 1965, Stuessy 377 (TEX) ; 7 mi S of Ario de Rosales, 20 Aug 1966, Stuessy 690 (TEX) ; 11 mi NW of Zamora, 23 Aug 1966, Stuessy 703 (tex). morelos: Cuernavaca, 31 Aug 1910, Orcutt 3887 (F). nayarit: 5 mi SE of Ixtlán del Río, 16 Aug 1961, Waterfall 16342 (SMU, UC). OAXACA: 53 mi S of Tehuacán, 13 Aug 1961, Powell \& Edmondson 660 (F, TEX) ; Valley of Oaxaca, 5 Jul 1897, Pringle 6728 (F, GH, NY, UC, US [2]) ; 38 mi S of Zimatlán, 12 Aug 1966,

Stuessy 642 (tex); 4 mi S of Sola de Vega, 13 Aug 1966, Stuessy 647 (TEX) ; $1 / 2 \mathrm{mi}$ NW of Las Sedas, 15 Aug 1966, Stuessy 660 (tex). puebla: Los Molinos between Puebla \& Atlixco, 18 Sep 1944, Sharp 44961 (ny). Querétaro: Jul 1904, Kuntze 27465 (ny [2]); 6 mi W of Querétaro, 6 Aug 1961, Powell \& Edmondson 579 (F, TEX); 4.7 mi N of Querétaro, 8 Aug 1959, Rock M-442 (TEX). SAN LUiS ротоsí: $15-16 \mathrm{mi}$ E of Ciudad del Maiz, 20 Sep 1960, Crutchfield \& Johnston 5664 (TEX); 3 mi E of Ciudad Maiz, 2 Sep 1948, Kenoyer \& Crum 4093 (GH); near San Luis Potosí, 1877, Schaffner 270 in part (ny). sonora: ca 2 mi W of Tres Ríos (ca 88 mi W of Vieja Casa Grandes, Chihuahua), 29 Aug 1952, Tucker 2565 (ARIz, US); Cañón de Huépari, N of Aribabi, 2-3 Sep 1939, White 2642 in part (GH). Zacatecas: between Colotlán \& Plateado, 31 Aug 1897, Rose 3617 ( $\mathrm{F}, \mathrm{US}$ ).
10. Melampodium pringlei Robins. Proc. Amer. Acad. Arts \& Sci. 36:461. 1901. TYPE: mexico: Oaxaca, Las Sedas, 1850 m, 15 Sep 1894, C. G. Pringle 5722 (Holotype, GH!).

Annual herbs, 30 cm tall. Stems ascending, 1-2 mm diam, hirsute-hispid with hairs up to 1 mm long. Peduncles 1-2 mm long. Leaves sessile, linear-oblong to oblanceolate, 22.8 cm long, $0.7-1.6 \mathrm{~cm}$ wide, at apex acute-obtuse, at base attenuate to obtuse, with upper surface strigose with hairs 1 mm long, with lower surface copiously sericeous; margin entire to 2-lobed, irregularly ciliate with hairs 0.3 mm long, near base hirsute with hairs $1-2 \mathrm{~mm}$ long. Heads $3-4 \mathrm{~mm}$ tall, $3.5-4 \mathrm{~mm}$ diam. Outer involucre cupulate, $3-4 \mathrm{~mm}$ diam ; bracts 5 , slightly connate at base, separate, lanceolate, $3-3.5 \mathrm{~mm}$ long, 1 mm wide, at apex acute-acuminate, with abaxial surface hirsute with hairs 1 mm long; margin herbaceous. Fruits 3 mm long, with lateral surfaces 3 ribbed with large tubercles. Ray florets $3-4$; ligules yellow, with undersurface near apex light purple, ovate, 1 mm long, 0.5 mm wide. Disc florets $2-3$; corollas yellow, 1.1 mm diam, with throat 0.6 mm and tube 0.5 mm long. Paleae oblanceolate, 2.5 mm long, 0.8 mm wide; apex purple, with margin erose-dentate; midrib prominent, weakly pilose with hairs 0.3 mm long. Chromosome number unknown.

Known only from the type collection from pine-oak forests near Las Sedas, Oaxaca, Mexico (Fig. 11), 1860 m. Flowering date, Sep.

Although this taxon is very similar to $M$. sericeum, it seems sufficiently distinct to be maintained as a separate species at the present time. Additional collections, however, may indicate that varietal status is preferable. I have searched the countryside around Las Sedas, the type locality, but have been unsuccessful in rediscovering the taxon. Characters (in addition to those listed in the key) which distinguish $M$. pringlei from its closeset relative are:
M. sericeum

1. Heads $4-5 \mathrm{~mm}$ tall, $4-8$ 1. Heads $3-4 \mathrm{~mm}$ tall, mm diam.
2. Outer involucral bracts narrowly rhombic to obovate, $3-7 \mathrm{~mm}$ long, 2-4 mm wide.
3. Ray florets 5-7.
4. Paleae yellow-tipped.
M. pringlei $3.5-4 \mathrm{~mm}$ diam.
5. Outer involucral bracts lanceolate, $3-3.5 \mathrm{~mm}$ long, 1 mm wide.
6. Ray florets 3-4.
7. Paleae purple-tipped.
8. Melampodium strigosum Stuessy, sp. nov.

Melampodium coronopifolium Sch. Bip. ex Hemsl. Biol. Centr. Am. Bot. $2: 145$. 1881. nom. nud. Based on several specimens including C. C. Parry \& E. Palmer 444 1/2 (GH! K! Mo! NY! US!).

Herbae annuae, 3-35 cm altae. Caules ascendentes, 0.6-2 mm diametro, moderate hispido-strigillosi, pilis $0.3-1 \mathrm{~mm}$ longis. Pedunculi $0-3(-11) \mathrm{mm}$ longi. Folia sessilia, ob-longo-linearia vel oblanceolata, $0.6-5 \mathrm{~cm}$ longa, $0.2-1.5 \mathrm{~cm}$ lata, apice acuto-obtusa, basi obtuso-subauriculata, utrinque strigosa pilis $0.2-0.6 \mathrm{~mm}$ longis, marginibus integris vel pinnatim 2-4 lobatis, basalibus strigoso-hispidis, pilis $0.3-$ 1.1 mm longis. Capitula $3-4 \mathrm{~mm}$ alta, $4-8 \mathrm{~mm}$ diametro. Involucrum extimum cupulatum, $3-8 \mathrm{~mm}$ diametro; bracteae 5 , basi leviter connatae, separatae, lanceolato-ellipticae, 2.76 mm longae, $1-2.9 \mathrm{~mm}$ latae, apice acutae, extus strigosohispidae in nervis principalibus, pilis $0.3-0.8 \mathrm{~mm}$ longis, marginibus herbaceis. Fructus $2.2-3 \mathrm{~mm}$ longi, lateribus striatis vel verrucatis, cucullis apice muticis vel cirrhosis,


Fig. 18. Map of Mexico and adjacent United States showing distribution of Melampodium strigosum (dots), M. sinaloense (square), and M. tepicense (triangles). One collection of M. strigosum from Colorado not shown.
mucrones 2-2.5 mm longis. Flosculi radii 5-8; ligulae flavae, oblongo-ovatae, $0.6-1.1 \mathrm{~mm}$ longae, $0.5-0.8 \mathrm{~mm}$ latae. Flosculi disci 4-6; corollae flavae, 1-2 mm diametro, faucibus 0.6 et tubis 0.5 mm longis. Paleae oblongo-ellipticae, 2.3 mm longae, 0.8 mm latae, apice flavae, marginibus dentatis, costis conspicuis, glabris vel puberulis pilis 0.1 mm longis. Chromosomatum numerus, $n=20$.

TYPUS: MEXICO: Chihuahua, ca 5 mi E of Ciudad Guerrero on rte 16, 21 Aug 1967, T. F. Stuessy 1054 (Holotype, US!; isotypes, F! GH! mich! ny! os! Smu! tex! UC!).

Pine-oak forests of central and northwestern Mexico, reaching Cochise, Pima and Santa Cruz Cos. of southeastern Arizona, Jeff Davis Co. of Texas, and Chaffee Co. of Colorado (Fig. 18), 1310-2590 m. Flowering dates, AugOct.

This new species is a common taxon that has masqueraded under the name of M. hispidum H.B.K. for many years. Dr. Rogers McVaugh first mentioned to me that the holotype of $M$. hispidum in the herbarium at Paris seemed conspecific with the even more common species, M. sericeum Lag. Having obtained additional information from Dr. Alicia Lourteig at Paris regarding the holotype of $M$. hispidum, I believe it is definitely conspecific with $M$. sericeum.

The placement of $M$. hispidum in synonymy with $M$. sericeum leaves M. coronopifolium Sch. Bip. ex Hemsl. as the only other name applicable to this taxon, but this latter epithet is a nomen nudum and therefore not validly published. By reference to three specimens cited in the protologue as being representative, however, $M$. coronopifolium is clearly referable to this species. I could now validate this available epithet, but I prefer to name this undescribed species with an epithet that emphasizes the distinctive strigose pubescence of the leaves in contrast to the markedly sericeous leaves of the morphologically similar $M$. sericeum.
representative specimens. Mexico. chinuahua: Parral, 19 Sep 1898, Goldman 110 (NY, US) ; San Diego Canyon, Sierra Madre Mts, 16 Sep 1903, Jones s.n. (РОМ) ; Sta Clara Mts, 10-19 Oct 1935,

LeSueur 341 (ARIZ, F, GH, TEX) ; near Chihuahua, Sep-Oct 1885, Pringle 297 (F, GH, NY, US [2]), 1 Jun 1885, Pringle 10 ( $\mathrm{F}, \mathrm{GH}, \mathrm{K}$, NY [2], US) ; mts near Chihuahua, Sep 1886, Pringle 754 (F, NY [2], UC [2], US [2]) ; near Chihuahua, 12 Sep 1886, Pringle 1045 (DS, NY, UC) ; ca $2-3 \mathrm{mi}$ W of Parral, 18 Aug 1967, Stuessy 1016 (TEX); 2 mi S of Cuauhtémoc, 20 Aug 1967, Stuessy 1038 (TEX); near Colonia García in Sierra Madre Mts, 26 Sep 1899, Townsend \& Barber 351 (GH, NY, US). DIStrito federal: Pyramid of Cuicuilco, Tlalpán, 1 Sep 1936, MacDaniels 747 (F); Valley of Mexico, 9 Sep 1896, Pringle 6491 (F, GH, NY, UC, US) ; above Santa Fe, Valley of Mexico, 4 Sep 1901, Pringle 8609 in part (GH) ; near Club Golf de Chapultepec, 4 Sep 1946, Zamora, Paxon \& Barkley 16M905 (TEx). durango: vicinity of Durango, Apr-Nov 1896, Palmer 486 (F, GH, ny, uc, us). Guanajuato: Guanajuato, Aug 1899, Dugès s.n. (US) ; Guanajuato, 1909, Furness s.n. (F). Hidalgo: near El Salto, 17 Sep 1901, Pringle 9331 (GH, NY, US) ; near Landa Station, 3 Sep 1903, Pringle 11548 (ARIZ, F, GH, SMU, US). QUERÉTARO: 22 mi NE of San Juan del Río, 10 Sep 1962, Turner \& Powell 1116 (TEx) ; 14 mi SE of San Juan del Río, 17 Aug 1957, Waterfall \& Wallis 13960 (SMU, US). SONORA: Cañón de Huépari N of Aribabi, 2-3 Sep 1939, White 2642 in part (ARIZ), 7 Sep 1939, White 2788 (DS). UNITED STATES. Arizona: Cochise co., Chiricahua Mts, 18 Sep 1907, Blumer 1665 (ARIZ, F, GH, NY, US) ; Portal, Chiricahua Natl Forest, 17-19 Sep 1914, Eggleston 10729 (Us) ; Lanner Canyon, Huachuca Mts, 24 Aug 1910, Goodding 814 (ARIZ, GH, US) ; Huachuca Mts, 20 Aug 1893, Holzner 1962 (Us) ; Chiricahua Mts, 22 Sep 1931, Jones s.n. (POM) ; Huachuca Mts, near Ft Huachuca, Sep 1882, Lemmon 2777 (F, GH, K, NY, UC) ; PIMA co., Rincon Mts, Dec 1907, Goodding 13 (ARIZ) ; SANTA CRUZ Co., Nogales, 23 Oct 1926, Jones 22681 (POM) ; Patagonia Mts, 18 Aug 1928, Kearney 5587A (us); Nogales, 7 Aug 1927, Peebles, Harrison \& Kearney 4614 (Us). Colorado: Chaffee co., Buena Vista, Jones s.n. (pom). Texas: Jeff davis co., Davis Mts, Madera Canyon, Aug 1936, Hinckley 620 (Ny), 3 Oct 1936, Hinckley 881 (ARIZ, F, GH, LL, NY [2], SMU); Davis Mts, Madera Creek, old Fisher Ranch House, 16 Sep 1944, Hinckley 3293 (Ll, US) ; Madera Canyon, Mt Livermore, Aug 1936, Hinckley s.n. (TEX); Madera Canyon, Davis Mts, 25 Aug 1967, Stuessy 1128 (TEX) ; 11 Sep 1959, Turner 4620 (SMU, TEX) ; N of Merrill ranch on rd to Mt Locke, 13 Aug 1950, Warnock 9229 (SMU) ; upper Madera Canyon, Davis Mts, 5 Oct 1955, Warnock 13507 (LL) ; Davis Mts, 18 Sep 1918, Young s.n. (TEx).
12. Melampodium longicorne A. Gray, Mem. Amer. Acad. ser. 2. 5:321. 1855. TYPE: MEXICO: Sonora, near Santa

Cruz, Sep 1851, G. Thurber 937 (Lectotype, GH!; isotypes, GH! K! Mo! NY!; photograph of K isotype, us!).

Annual herbs, $12-60 \mathrm{~cm}$ tall. Stems erect, $0.9-2.8 \mathrm{~mm}$ diam, subglabrous to hispid-strigose with hairs $0.5-1 \mathrm{~mm}$ long. Peduncles $4-30 \mathrm{~mm}$ long. Leaves sessile, linear-oblong to oblanceolate, $3-5 \mathrm{~cm}$ long, $0.3-1.2 \mathrm{~cm}$ wide, at apex obtuse, at base truncate-subauriculate, with both surfaces strigose with hairs $0.3-0.8 \mathrm{~mm}$ long; margin entire to obscurely dentate, at base hispid-hispidulous with hairs $0.5-1$ mm long. Heads $4-7 \mathrm{~mm}$ tall, $7-13 \mathrm{~mm}$ diam. Outer involucre cupulate, 6-8(-10) mm diam, bracts 5 , slightly connate at base, usually imbricate $2 / 3$ their length (less often separate), elliptic to obovate-rhombic, 4.3-6.8 mm long, 2-4 mm wide, at apex acute, with abaxial surface moderately strigose with hairs $0.5-1 \mathrm{~mm}$ long; margin herbaceous. Fruits $3-3.6 \mathrm{~mm}$ long, with lateral surfaces granulate to aculeate-verrucate; hood apex cirrhous, with appendage over 4 mm long. Ray florets $7-12$; ligules yellow, oblongelliptic, 1.2-1.5 mm long, $0.7-0.9 \mathrm{~mm}$ wide. Disc florets $8-10$; corollas yellow, 1 mm diam, with throat 0.5 mm and tube 0.4 mm long. Paleae oblong-elliptic, 3.4 mm long, 1.1 mm wide; apex yellow, with margin bidentate; midrib prominent, strigillose with hairs 0.1 mm long. Chromosome number, $n=30$.

Mountains of southeastern Arizona in Cochise, Pima and Santa Cruz Cos., and in adjacent Sonora, Mexico (Fig. 19), 1130-1830 m. Flowering date, Sep.

Found exclusively in southeastern Arizona and neighboring Sonora, this species is often conspicuous with its long coiled awns on the hoods of the ray achenes. Just as often, however, the awns are absent, making separation from the morphologically similar $M$. strigosum difficult. In the area of sympatry in Arizona, there is a trend in M. strigosum toward longer peduncles, more entire leaves, and more erect stems, suggesting that hybridization may be occurring between the two taxa.

Asa Gray seems to have experienced some difficulty in delimiting $M$. longicorne, even though he himself described


Fig. 19. Map of northwestern Mexico and adjacent United States showing distribution of Melampodium appendiculatum (squares), M. cupulatum (triangles), M. longicorne (circles), and M. sinuatum (dots).
it as new. He first (1855) confused a Wright 1205 collection (distinct $M$. longicorne) with $M$. strigosum and later (1859) emended his original description to include a Schott 72 collection, the latter being treated subsequently as belonging to M. appendiculatum (Robinson, 1901; present treatment).

Confusion has existed regarding the correct spelling of the specific epithet, and some workers (Robinson, 1901; Tidestrom and Kittell, 1941; Gentry, 1942) have elected to use the form longicornu rather than longicorne as originally published. Even Gray himself ceased to use the original adjectival spelling and reverted to the substantive form longicornu in his subsequent publications of 1859 and 1884. However, as longicorne is the original correct spelling, I have used this form in the present treatment, as have other workers in recent times (Kearney and Peebles, 1942, 1964; Shreve and Wiggins, 1964).
representative specimens. Mexico. sonora: 2 mi E of Agua Prieta-Nacozari rd to Oputo \& Angostura, 7 Sep 1961, Turner, Dodge \& Mason 2068 (ariz, DS) ; near Santa Cruz, 1851, Wright 1205 (G, GH [3], к, Ny, Us). UNITED STATES. Arizona: Cochise co., 10 mi N of Chiricahua Station, 8 Sep 1942, Barneby 5135 (NY); Chiricahua Mts, N of Wilgus Ranch, 2 Sep 1907, Blumer 2128 (F, GH, Ny); Ft Huachuca Military Reservation, 29 Sep 1962, Goodding 267-62 (ariz) ; Huachuca Game Preserve, Garden Canyon, 21 Sep 1949, Goodding 580-49 (ariz [2]) ; Montezuma Canyon, Huachuca Mts, 17 Oct 1958, Goodding 699-58 (ARIZ, UC) ; Ramsey Canyon, Huachuca Mts, 29 Sep 1929, Jones 25045 (Ny [2], pom, tex [2], uc [2]); Huachuca Mts, 3 Sep 1903, Jones s.n. (NY, POM) ; near Apache Pass, Chiricahua Mts, Sep 1881, Lemmon 331 (F, UC [2]) ; Huachuca Mts, Aug 1882, Lemmon 2795 (F, G, NY, US) ; $41 / 2 \mathrm{mi} \mathrm{S}$ of Sonoita \& Parker Canyon rds, 10 Oct 1965, Reese 94 (ARIZ); Bear Canyon, Huachuca Mts, 28 Aug 1936, Shreve 7709 (ARIz) ; near Ft Huachuca, Aug 1894, Wilcox 335 (US); Ft. Huachuca, Aug 1893, Wilcox s.n. (Ny) ; Pima co., Oak Tree Canyon, Thurber Ranch, Santa Rita Mts, 14 Oct 1940, Benson 10598 (ariz); Madera Canyon, Santa Rita Mts, 6 Sep 1944, Clark 12377 (ARIZ); 17 mi S of TucsonBenson hwy on rte 83, 21 Oct 1944, Gould 2883 (ARIZ); Thurber Ranch, Santa Rita Mts, 14 Sep 1945, Gould \& Haskell 3268 (ariz, DS, GH, NY, UC, US) ; Santa Rita Mts, 24 Aug 1903, Jones s.n. (DS, POM) ; Madera Canyon, Santa Rita Mts, 24 Aug 1926, Loomis \& King 2890 (ARIz) ; Santa Rita Mts, 16 Sep 1884, Pringle 55 (GH, SMU) ; Greaterville, 16 Sep 1916, Shreve 4965 (ariz); Empire Ranch, 26 Aug 1936, Shreve 7685 (ariz, smu) ; Santa Rita Mts, Rozemont, 20 Sep 1915, Thornber 7404 (ariz), 10 Sep 1915, Thornber 8121 (ARIZ), 20 Sep 1915, Thornber 9050 (ariz) ; Santa CRUZ Co., Sycamore Creek, ca 23 mi NW of Nogales, 20 Sep 1964, Cronquist 10003 (ny) ; Sycamore Canyon, near Ruby, 30 Sep 1944, Darrow \& Haskell 2012 (Ariz, NY, UC, US); near Canoa Tank, Summit Motorway, on

Nogales-Ruby rd, 14 Oct 1944, Darrow \& Haskell 2256 (ARIZ); Patagonia, 14 Sep 1959, Goodding 248-59 (ARIz); Sonoita Creek, 30-31 Aug [year?], Harrison 8181 (F); Nogales, 30 Aug 1931, Harrison \& Fulton 8153 (ariz, us) ; Sonoita, 2 Sep 1928, Harrison \& Kearney 5702 (us); Patagonia Mts, 15 Sep 1934, Kearney \& Peebles 10052 (UC) ; Sycamore Canyon, SW of Atascosa Mts \& SE of Ruby, 3 Oct 1951, Parker 7707 (ARIZ, F, RSA, UC, US) ; Patagonia Mts (Nogales), 28 Aug 1927, Peebles \& Harrison 4680 (ariz, F); Harshaw, 22 Aug 1932, Shreve 6003 (ariz, f).
13. Melampodium nayaritense Stuessy, Brittonia 22:113. f. 5. 1970. TYPE: MEXICO: Nayarit, Cañon de Jesús María, 1000 ft, 29 Aug 1905, P. Goldsmith 133 (Holotype, NY!; isotypes, F! GH! MO! UC! US!).

Annual herbs, $10-30 \mathrm{~cm}$ tall. Stems ascending to erect, $1-2 \mathrm{~mm}$ diam, hirtellous with hairs 0.5 mm long. Peduncles $1.5-3.6 \mathrm{~cm}$ long. Leaves sessile, linear and entire to deeply pinnately divided, $3-4.5 \mathrm{~cm}$ long, $0.2-3.7 \mathrm{~cm}$ wide, at apex acute, at base attenuate to obtuse, with upper surface finely strigose with hairs 1 mm long, with lower surface sericeous; margin at base pilose-hispid with hairs up to 1.5 mm long. Heads 5-6 mm tall, $8-11 \mathrm{~mm}$ diam. Outer involucre cupulate, $7-10 \mathrm{~mm}$ diam ; bracts 5 , slightly connate at base, separate, obovate-rhombic, $1.5-5.5 \mathrm{~mm}$ long, $3-3.5 \mathrm{~mm}$ wide, at apex acute-acuminate, with abaxial surface pilose with hairs 1 mm long; margin herbaceous. Fruits 3 mm long, with lateral surfaces ribbed and smooth to markedly tuberculate ${ }^{10}$; hood apex cirrhous, with tapering appendage up to 2 mm long. Ray florets $5-6$; ligules yellow, ovate-orbiculate, 2 mm long, 2 mm wide. Disc florets $15-25$; corollas yellow, 1.2 mm diam, with throat 0.8 mm and tube 0.6 mm long. Paleae broadly oblanceolate, 3.5 mm long, 1.6 mm wide; apex yellow, with margin entire and undulate; midrib prominent, weakly pubescent with hairs 0.3 mm long. Chromosome number unknown.

Known from woodland hills in northeastern Nayarit, and adjacent Durango, Mexico (Fig. 20), 180-300 m. Flowering dates, Aug-Sep.

[^9]

Fig. 20. Map of Mexico showing distribution of Melampodium bibracteatum (dots), M. nayaritense (squares), M. repens (circles), $M$. rosei (closed triangles), and $M$. tenellum (open triangles). One collection of $M$. bibracteatum from Guatemala not shown.
representative specimens. Mexico. durango: Huasemota, 14 Aug 1897, Rose 3476 (us). Nayarit: Valley of Río Jesús María, near village of Jesús María, 17 Sep 1960, Feddema 1209 (MICH).
4. Series Cupulata Stuessy, ser. nov.

Herbae annuae vel perennae ( $M$. sinuatum) ; folia anguste ovata (saepe lobata), subtus strigosa; ligulae luteae vel flavo-aurantiacae, plus quam vel raro circa 2 mm longae; involucrum extimum marginibus scariosis; fructi plerumque cucullati. Species 14-19. Typus: Melampodium cupulatum A. Gray.
14. Melampodium cupulatum A. Gray, Proc. Amer. Acad. Arts \& Sci. 8:291. 1870. TYPE: mexico: Sonora, Río Yaqui [27³7' N, $110^{\circ} 38^{\prime}$ W; McVaugh, 1956], Nov-Dec 1869, E. Palmer 20 (Holotype, GH!; isotypes, NY! US[2]!; photograph of US isotype, TEX!).

Eclipta pusilla M. E. Jones, Contrib. West. Bot. 18:70. 1933. TYPE: mexico: Baja California, Loreto, Arroyo Undo Ranch, 26 Oct 1930, M. E. Jones 27739 (Holotype, Ром!).

Annual herbs, $10-35 \mathrm{~cm}$ tall. Stems erect, $1-4 \mathrm{~mm}$ diam, moderately puberulent to hispidulous with hairs $0.1-0.3 \mathrm{~mm}$ long. Peduncles $3.5-8 \mathrm{~cm}$ long. Leaves sessile or with short petioles 2-3 mm long, ovate-lanceolate, 3.3-7.5 cm long, $0.8-$ 2.1 cm wide, at apex acute, at base attenuate, with both surfaces strigillose with hairs $0.2-0.3 \mathrm{~mm}$ long; margin entire to broadly crenate or sinuate on upper $3 / 4$ of blade. Heads $7-8 \mathrm{~mm}$ tall, $9-17 \mathrm{~mm}$ diam. Outer involucre cupulate, $6.5-10 \mathrm{~mm}$ diam; bracts 5 , connate $1 / 2$ their length, ovate to narrowly ovate, $4-6 \mathrm{~mm}$ long, 2.7-3.3 mm wide, at apex acute-acuminate, with abaxial surface strigillose with hairs $0.2-0.8 \mathrm{~mm}$ long; margin scarious. Fruits $3-3.4 \mathrm{~mm}$ long, with lateral surfaces with small tubercles and reticulations. ${ }^{11}$ Ray florets $8-12$; ligules yellow-orange, oblong-elliptic, $3-6 \mathrm{~mm}$ long, $1-3 \mathrm{~mm}$ wide. Dise florets $40-60$; corollas yellow-orange, 2 mm diam, with throat 0.7 mm and tube 0.3 mm long. Paleae oblanceolate, 3.5 mm long, 1 mm wide; apex yellow, with margin erose; midrib prominent, puberulous with hairs 0.1 mm long. Chromosome number, $n=10$.

Arid regions of Baja California, Sinaloa, Sonora, and Nayarit, Mexico (Fig. 19), 30-790 m. Flowering dates, SepMar.
representative specimens. Mexico. baja california: vicinity of La Cumbre de Alta Gracia, 1 Nov 1964, Carter 4880 (ds, UC) ; Mesa del Potrero de San Javier, 19 Sep 1965, Carter 4964 (DS, UC) ; Cerro Gabilán, S of Portezuelo de Gabilán, 30 Sep 1965, Carter 5055 (UC);

[^10]NE end of Valle de Los Encinos (S side of Cerro Giganta), 28 Sep 1967, Carter \& Moran 5314 (UC); 2 mi E of Comondú on rd to Loreto, 28 Aug 1955, Chambers 965 (DS, UC) ; N of Comondú, 3 Oct 1941, Hammerly 182 (DS, Ром); 8 mi S of Querétaro, 29 Nov 1946, Wiggins 11507 (DS, GH, UC, US). Nayarit: near Jesús María, 18 Sep 1960, Feddema 1219 ( Mich). sinaloa: 5 mi W of Culiacán on rd to Altata, 28 Jan 1964, Flyr 112 (tex); Cerro Tecomate, W of Pericos, 28 Feb 1940, Gentry 5750 (ariz, DS, GH, NY, UC); Maratón, 12 mi W of Culiacán, 9 Mar 1944, Gentry 7005 (DS, F, GH, Ny, UC, US) ; near Culiacán, Oct [year?], Schaffner s.n. (GH). SONORA: near rr station, Masiaca, 13 Sep 1930, Abrams 12811 (DS) ; Ciudad Obregón, 29 Sep 1933, Gentry 290 (DS); Alamos, 26 Mar-8 Apr 1890, Palmer 726 (GH) ; 4 mi S of La Puerca, SW of Hermosillo toward Tastiota, 4 Sep 1941, Wiggins \& Rollins 281 (DS, GH, NY, UC, US).
15. Melampodium appendiculatum Robins. Proc. Amer. Acad. Arts \& Sci. $36: 457$. 1901. TYpe: mexico: Chihuahua, near Frailes [ca 12 km NE of Guachóchic; McVaugh, 1956], ca 7400 ft , Oct 1885, E. Palmer 245 (Holotype, GH!; isotype, US!; photograph of US isotype, TEX!).

Melampodium appendiculatum Robins. var. leiocarpum Robins. Proc. Amer. Acad. Arts \& Sci. 36:457. 1901. TYPE : mexico: Sonora, Alamos, 16-30 Sep 1890, E. Palmer 726 (not 726, 26 Mar-8 Apr 1890) (Holotype, GH!; isotypes, NY! US!).

Melampodium appendiculatum Robins. var. sonorense Robins. Proc. Amer. Acad. Arts \& Sci. 36:457. 1901. TYPE : mexico : Sonora, Cochuto, $5100 \mathrm{ft}, 2$ Oct 1890, C. V. Hartman 71 (Holotype, GH!).

Annual herbs, $10-40 \mathrm{~cm}$ tall. Stems erect, $1-3 \mathrm{~mm}$ diam, subglabrous at base to hispid or pilose above with hairs $0.5-1.5 \mathrm{~mm}$ long. Peduncles $1-8 \mathrm{~cm}$ long. Leaves sessile, linear to lanceolate, $2.5-8.3 \mathrm{~cm}$ long, $0.4-1.8 \mathrm{~cm}$ wide, at apex acute, at base subauriculate, with both surfaces stri-gose-hispid with hairs $1-1.5 \mathrm{~mm}$ long; margin entire to obsoletely crenate, at base hispid with hairs up to 2 mm long. Heads $5-8 \mathrm{~mm}$ tall, $7-17 \mathrm{~mm}$ diam. Outer involucre strongly cupulate, $4.5-8 \mathrm{~mm}$ diam; bracts 5 , connate $2 / 3$ their length, ovate, $3.5-4.5 \mathrm{~mm}$ long, $2-3 \mathrm{~mm}$ wide, at apex acute, with abaxial surface pubescent-pilose with hairs 0.5
mm long (longer near base) ; margin scarious. Fruits 2.32.8 mm long, with lateral surfaces smooth and glabrous to very tuberculate and striate; hood apex cirrhous (rarely muticous or mucronate) ${ }^{12}$, with appendage up to 4 mm long. Ray florets 8-13; ligules yellow-orange, oblong-elliptic, 2-8 mm long, $1-2.9 \mathrm{~mm}$ wide. Disc florets $25-40$; corollas yellow, 1.3 mm diam, with throat 0.7 mm and tube 0.4 mm long. Paleae oblancolate, 3.2 mm long, 1 mm wide; apex yellow, with margin dentate-laciniate; midrib prominent, puberulent with hairs 0.1 mm long. Chromosome number unknown.

Pine-oak forests in mountains of Sonora, Chihuahua and northwestern Durango, Mexico (Fig. 19), 790-1390 m. Flowering dates, Jul-Nov.

Robinson (1901) described two new varieties within this species based on inner involucral bract differences. From an examination of specimens that indicate intra- and interpopulational variability, however, it seems clear that these described varieties represent simply forms within the morphological range of one species.
representative specimens. Mexico. chihuahua: Guasaremos, Río Mayo, 5 Aug 1935, Gentry 1570 (ARIZ, F, GH, NY, UC, Us), 3 Aug 1936, Gentry 2353 (ARIZ, F, GH); Río Aros, 23 Jul 1937, LeSueur 1466 (TEX), 28 Jul 1937, LeSueur 1472 (F) ; Sierra Madre Mts near Seven Star Mine, 27 Aug 1899, Townsend \& Barber 376 (F, GH, NY, POM, UC, US [2]). DURANGO?: Lodiego [ca $25^{\circ} \mathrm{N}, 106^{\circ} 45^{\prime} \mathrm{W}$; McVaugh, 1956], 9-15 Oct 1891, Palmer 1609 in part (F, GH, NY, Us). SONORA: 20 mi NE of Ures, 16 Nov 1939, Drouet, Richards \& Lockhart 3609 (F) ; Baviácora, W of Río de Sonora, 17 Nov 1939, Drouet, Richards \& Lockhart 3624 (F) ; Alamos, Quirocoba, 13 Nov 1933, Gentry 790 M [790] (ARIz, DS); San Bernardo, Río Mayo, 14 Jul 1935, Gentry 1492 (F, GH); 6 mi S of Nogales, 7 Aug 1965, R. \& J. Matthews 480 (TEX); San Bernardino Ranch, 22 Aug 1893, Mearns 1997 (US) ; ca 12 mi from Cananea at km 20 on rd to Bacanuchi, 25 Aug 1963, Moreno MS-198 (ARIz) ; Nácori Chico, Pie de la Cuesta, 6 Oct 1939, Muller 3659 (F, UC) ; Aduana, 10 Aug 1930, Russell \& Souviron 2 (Us); Sta Magdalena, Nov 1855, Schott 72 (F, GH, NY),

[^11]Schott s.n. (F) ; 21 mi SE of Moctezuma, 25 Sep 1934, Shreve 6758 (ARIZ, US) ; Arispe, 18 Aug 1958, Turner 192 \& Lowe 2074 (ARIZ); 31 mi S of Nogales along Río de los Alisos, 8 Sep 1934, Wiggins 7021 (DS, TEX [2], US) ; ca 5 mi S of Babiácora along Sonora River, 21 Sep 1934, Wiggins 7388 (ARIZ, DS, TEX [2], US); 21 mi S of Moctezuma, 25 Sep 1934, Wiggins 7444 (ariz, DS, TEX, US) ; 8 mi S of Nogales \& 2 mi W of rr, 3 Oct 1934, Wiggins 7533 (DS, Us); 8 mi from Matape toward Batuc, 9 Sep 1941, Wiggins \& Rollins 433 (ariz, dS, GH, NY) ; Puerto de Huépari, NW of Aribabi, 7 Sep 1939, White 2784 (ARIZ, GH, US) ; Cañón de la Gallina, 25 Aug 1940, White 3516 (ariz, GH) ; El Rancho de la Nacha, 25 mi W of La Angostura, 14-20 Aug 1941, White 3908 (GH); Cañón de la Palomita, N of El Tigre, 29 Aug 1941, White 4153 (GH).
16. Melampodium sinuatum Brandg. Proc. Calif. Acad. Sci. ser. 2. $3: 144$. 1891. TYPE: mexico: Baja California, San José del Cabo, 16 Sep 1890, T. S. Brandegee 302 (not 302, Sep 1891; not 302, 10 Mar 1892) (Lectotype chosen, UC!).

Suffruticose perennials, $8-35 \mathrm{~cm}$ tall. Stems erect, 1-2 mm diam, puberulent-canescent with hairs $0.2-0.5 \mathrm{~mm}$ leng. Peduncles $3-9 \mathrm{~cm}$ long. Leaves sessile, linear to elliptic, $2-4.5 \mathrm{~cm}$ long, $0.5-1.6 \mathrm{~cm}$ wide, at apex obtuse, at base subauriculate, with both surfaces densely strigillose with hairs $0.2-0.3 \mathrm{~mm}$ long; margin sinuate-undulate (rarely repand) to irregularly lobed. Heads $6-7 \mathrm{~mm}$ tall, $10-20 \mathrm{~mm}$ diam. Outer involucre cupulate, $6-9.5 \mathrm{~mm}$ diam; bracts 5 , connate $3 / 4$ their length, orbiculate, $3-4.5 \mathrm{~mm}$ long, 2.5-4.5 mm wide, at apex obtuse, with abaxial surface strigillosetomentose with hairs $0.4-0.7 \mathrm{~mm}$ long; margin slightly scarious. Fruits $2.9-3.2 \mathrm{~mm}$ long, with lateral surfaces tuberculate-striate or reticulate. Ray florets 9-13; ligules yellow-orange, elliptic-linear, $4-9 \mathrm{~mm}$ long, $1.5-3 \mathrm{~mm}$ wide. Disc florets $50-80$; corollas yellow-orange, 1.3 mm diam, with throat 1 mm and tube 0.5 mm long. Paleae broadly oblanceolate, 3.5 mm long, 0.8 mm wide; apex yellow, with margin erose-laciniate; midrib prominent, puberulent with hairs 0.1 mm long. Chromosome number unknown.

Low granitic hills near San José del Cabo, Baja California, Mexico (Fig. 19), ca 60 m. Flowering dates, Sep-Mar.
$M$. sinuatum is one of the three species in the genus, along with $M$. cupulatum and $M$. divaricatum that are found in Baja California. The distributional and morphological similarity of the former two taxa, and the restricted distribution of $M$. sinuatum at the tip of Baja California suggest that this species may have been derived from a mainland ancestral population of M. cupulatum.
representative specimens. Mexico. baja callifornia: San José del Cabo, Sep 1891, Brandegee 302 (GH, Us) ; Sierra de la Trinidad, Nov 1902, Brandegee s.n. (UC [2], us) ; 12.2 km SW José del Cabo, 16 Dec 1947, Carter, Alexander \& Kellogg 2216 (DS, UC, US) ; San José del Cabo, Mar 1901, Purpus 416 (UC, US) ; 5 mi W of San José del Cabo, 17 Dec 1958, Wiggins 14377 (DS, GH, TEX, UC).
17. Melampodium rosei Robins. Proc. Amer. Acad. Arts \& Sci. 36:461. 1901. TYPE: MEXICO: Sinaloa, between Rosario \& Concepción, 28 Jul 1897, J. N. Rose 3271 (Holotype, us!; photograph of holotype, TEX!).

Melampodium arenicola Robins. Proc. Amer. Acad. Arts \& Sci. 36:457. 1901. TYPE: MExico: Sinaloa, Mazatlán, Isla Piedra, 31 Dec 1894, F. H. Lamb 361a (Holotype, GH!; isotypes, $\mathrm{G}[2]$ ! mo! NY! US!; photograph of US isotype, TEX!).

Melampodium rosei Robins. var. subintegrum Robins. Proc. Amer. Acad. Arts \& Sci. 36:462. 1901. tYPE: mexico: Sinaloa, Rosario, 7 Jul 1897, J. N. Rose 1568 (Holotype, US!; isotypes, F! GH!; photograph of holotype, TEX!; photograph of K isotype, US!).

Annual herbs, $10-50 \mathrm{~cm}$ tall. Stems erect to decumbent, $1-3 \mathrm{~mm}$ diam, glabrous near base to hispidulous above with hairs up to 0.5 mm long. Peduncles $2-5 \mathrm{~cm}$ long. Leaves sessile, lanceolate to oblong-ovate, $3-5.5 \mathrm{~cm}$ long, $0.5-2 \mathrm{~cm}$ wide, at apex obtuse to acute, at base subauriculate (rarely obtuse), with both surfaces strigose with hairs $0.3-1 \mathrm{~mm}$ long; margin subentire to strongly lobed. Heads $4-6 \mathrm{~mm}$ tall, $7-12 \mathrm{~mm}$ diam. Outer involucre cupulate, $5-8 \mathrm{~mm}$ diam; bracts 5 , connate $1 / 4$ or less their length at base, separate to imbricate $3 / 4$ their length, orbiculate to ovate, $2.5-3.8 \mathrm{~mm}$ long, $1.5-3.5 \mathrm{~mm}$ wide, at apex broadly rounded to acute, with abaxial surface subglabrous to strigillose
with hairs 0.3 mm long (longer near base) ; margin scarious. Fruits 1.1-2.3 mm long, with lateral surfaces smooth to striate (sometimes very tuberculate); hood apex muticous or less often mucronate to cirrhous, with appendage up to 3 mm long. Ray florets 8-9; ligules yellow-orange, ob-long-elliptic, $3-6 \mathrm{~mm}$ long, 1-2.3 mm wide. Disc florets $40-$ 60 ; corollas yellow-orange, 1.6 mm diam, with throat 0.7 mm and tube 0.5 mm long. Paleae broadly oblanceolate, 2.7 mm long, 0.8 mm wide; apex yellow, with margin laciniate; miadrib prominent, weakly puberulent with hairs 0.2 mm long. Chromosome number, $n=10$.

Tropical deciduous and thorn forests in Sinaloa and adjacent Durango, Mexico (Fig. 20), 0-400 m. Flowering dates, Aug-Jan.

Some of the specimens on Isla Piedra off the coast of Mazatlán (type locality of M. arenicola) possess more lobed leaves, a tendency toward decumbent stems, larger heads, and narrower and longer ligules than is typical for the species. Because these forms exhibit considerable character intergradations and are found also intermixed in at least one population on the mainland (personal observations), they are not here formally recognized. With $M$. arenicola and $M$. rosei regarded as being conspecific and because both names were published at the same time, one of the epithets must be selected for use. M. rosei has been chosen because this name has been applied almost exclusively in identifications of previous collections of this taxon.

Collections from Ymala (Imala), Sinaloa, at the northwest portion of the range of this species morphologically approach M. cupulatum, a species found nearby (Fig. 19). Hybridization between the two taxa cannot be exluded.
representative specimens. Mexico. durango: La Bajada, Tamazula, Nov 1921, Ortega 4446 (us). SinaloA: Mazatlán, 3 Nov 1893, Brandegee s.n. (US) ; 2 mi SE of Mazatlán, 4 Aug 1938, Eyerdam \& Beetle 8687 (ariz, UC) ; Mazatlán, 15 Sep 1927, Ferris 5020 (DS); vicinity of Labradas, 18 Sep 1925, Ferris \& Mexia 5078 (DS, GH) ; near Mazatlán, 29 Jan 1964, Flyr 138 (TEX) ; ca 2 mi N of Escuinapa, 13 Aug 1960, King 3707 (DS, Ny, TEX, Uc, Us) ; ca 12 mi N of Escuinapa, 13 Aug 1960, King 3709 (DS, Ny, RSA, TEx, UC) ; ca 13 mi N
of Rosario, 13 Aug 1960, King 3710 (DS, Ny, TEx, UC, US) ; ca 21 mi N of Rosario, 13 Aug 1960, King 3712 (DS, Ny, TEX, UC, US) ; ca 3 mi S of Mazatlán, 13 Aug 1960, King 3715 (DS, Ny, TEX, UC, US) ; ca 10 mi NE of jet rtes 15 \& 40, 14 Aug 1960, King 3716 (DS, Ny, TEX, UC) ; Mazatlán, on Isla Piedra, 31 Dec 1894, Lamb s.n. (DS, UC, US) ; Mazatlán, 2 Jan 1895, Lamb s.n. (DS, GH, NY, UC, US) ; San Agustín, 1921, Ortega 4008 (US) ; Escuinapa, 1926, Ortega 6125 (Us), 1933, Ortega 7004 (F) ; Ymala [Imala], [ $25^{\circ} 42^{\prime} \mathrm{N}, 107^{\circ} 15^{\prime} \mathrm{W}$; McVaugh, 1956], 16-25 Aug 1891, Palmer 1457 (F, GH, Us), 25 Sep-8 Oct 1891, Palmer 1757a (ARIZ, GH, US) ; 10 mi E of jct rtes $15 \& 40$, 26 Aug 1961, Powell \& Edmondson 908 (TEX) ; near Colomas, 19 Jul 1897, Rose s.n. (US) ; between Mazatlán \& Villa Unión, 14 Dec 1936, Shreve 7821 (ARIz, F) ; 4.5 mi N of Escuinapa, 4 Sep 1965, Stuessy 404 (TEX) ; Isla Piedra, Mazatlán, 28 Aug 1966, Stuessy 748 (TEX); 4 mi S of Mazatlán, 28 Aug 1966, Stuessy 750 (TEX); 12-15 km SE of Mazatlán, 4 Aug 1938, Worth \& Morrison 8807 (Uc, Us) ; Mazatlán \& vicinity, Dec 1888, Wright 1213 (DS, F, UC, US).
18. Melampodium tenellum Hook. \& Arn. Bot. Beech. Voy. 299. 1838. TYPE: MEXICO: Nayarit, Tepic, 1825-28, G. T. Lay \& A. Collie et al. s.n. (Holotype, K!; photograph of holotype, F! MICH! OS! TEX! US!; photograph and fragment of holotype, US!).

Annual herbs, $6-30 \mathrm{~cm}$ tall. Stems erect (rarely decumbent), 1-2 mm diam, subglabrous to hispidulous with hairs 0.3 mm long. Peduncles $3-7 \mathrm{~cm}$ long. Leaves sessile or with petioles $2-10 \mathrm{~mm}$ long, lanceolate to narrowly ovate, $2-5.5$ cm long, $0.5-1.4 \mathrm{~cm}$ wide, at apex obtuse (less often acute), at base attenuate (rarely obtuse), with both surfaces scatteredly strigose with hairs 0.3 mm long; margin subentire to shallowly lobed. Heads $3.5-5.5 \mathrm{~mm}$ tall, $6-14 \mathrm{~mm}$ diam. Outer involucre cupulate, $3.5-7 \mathrm{~mm}$ diam; bracts 5 , connate 1/4-1/2 their length, separate to imbricate, orbiculate to ovate, $2.5-3.5 \mathrm{~mm}$ long, $2.5-3 \mathrm{~mm}$ wide, at apex acute to rounded, with abaxial surface strigillose-hispidulous with hairs 0.3 mm long; margin scarious. Fruits $1.8-2.6 \mathrm{~mm}$ long, with lateral surfaces usually with 4 longitudinal rows of tubercles (rarely smooth) ; hood apex muticous. Ray florets $8-9$; ligules yellow-orange, oblong-elliptic, $2-5 \mathrm{~mm}$ long, $1-2.8 \mathrm{~mm}$ wide. Disc florets $40-60$; corollas yelloworange, 1.3 mm diam, with throat 0.8 mm and tube 0.5 mm
long. Paleae oblanceolate, 2.5 mm long, 0.7 mm wide; apex yellow, with margin laciniate; midrib prominent, glabrous. Chromosome number, $n=10$.

Tropical deciduous forests and savannas in Nayarit, Jalisco, and Michoacán, Mexico (Fig. 20), 30-920 m. Flowering dates, Jul-Nov.
M. tenellum is morphologically similar to $M$. rosei, but each species does possess unique morphological and geographic features. As in M. rosei, however, M. tenellum also has considerable variation in vegetative and outer phyllary morphology. Much additional work will be needed before this intraspecific variation can be understood satisfactorily.

REPRESENTATIVE SPECIMENS. Mexico. JALISCO: Puerto Vallarta, 20 Jul 1932, Howell 10303 (US). Michoacán: 24 km S of Arteaga, 29 Nov 1968, Rzedowski 26618 (os). nayarit: E of Tepic along Río Tepic, 22-24 Aug 1935, Pennell s.n. (GH) ; Santiago Ixc., Mezcaltitán, Jan 1926, González 6125 (DS, US) ; ca 38 mi S of NayaritSinaloa border on rte 15, 12 Aug 1960, King 3703 (DS, NY, tex, uc, US) ; ca 28 mi S of Nayarit-Sinaloa border on rte 15, 12 Aug 1960, King 3704 (DS, NY, RSA, TEX, UC) ; ca 21 mi S of Nayarit-Sinaloa border on rte 15, 13 Aug 1960, King 3705 (dS, Ny, tex, Uc, US); ca 1 mi S of Nayarit-Sinaloa border on rte 15, 13 Aug 1960, King 3706 (DS, Ny, RSA, TEX, UC) ; 27.9 mi SE of Nayarit-Sinaloa border on rte 15, 4 Sep 1965, Stuessy 401 (tex) ; 10 mi NW of jct rte 15 \& rd to Tuxpán, 27 Aug 1966, Stuessy 745 (TEX).
19. Melampodium glabribracteatum Stuessy, Brittonia 22: 112. $f$. 3. 1970. tyPe: mexico: Oaxaca, Cerro de San Antonio, Ocotlán, $1600 \mathrm{~m}, 29$ Aug 1936, C. Conzatti 5169 (Holotype, k !; photograph of holotype, os! TEx!).

Annual herbs, $15-22 \mathrm{~cm}$ tall. Stems erect to decumbent, 1-1.5 mm diam, subglabrous at base to pilose above with hairs up to 1 mm long. Peduncles $1 \cdot 3-1.7 \mathrm{~cm}$ long. Leaves sessile, blades lanceolate, $2-3.3 \mathrm{~cm}$ long, $0.4-0.7 \mathrm{~cm}$ wide, at apex obtuse, at base obtuse-subauriculate, with both surfaces sparingly strigose with hairs up to 1 mm long; margin entire or rarely 2 -lobed, near base pilose with hairs up to 1 mm long. Heads $5-6 \mathrm{~mm}$ tall, $6-9 \mathrm{~mm}$ diam. Outer involucre cupulate, $7-8 \mathrm{~mm}$ diam; bracts 5 , slightly connate
at base, imbricate $3 / 4$ their length, elliptic-orbiculate, 3-4 mm long, $2.4-3.2 \mathrm{~mm}$ wide, at apex rounded, with abaxial surface glabrous; margin narrowly scarious, ciliate with hairs up to 0.6 mm long. Fruits $2.1-2.5 \mathrm{~mm}$ long, with laterai surfaces ribbed and tuberculate-aculeate; hood apex cirrhous, with tapering appendage up to 2 mm long. Ray florets 6-8; ligules yellow, ovate-oblong, 3.5 mm long, 2-2.5 mm wide. Disc florets ca 30 ; corollas yellow, 1 mm diam, with throat 1 mm and tube 0.7 mm long. Paleae oblanceolate, 3.3 mm long, 0.8 mm wide; apex yellow, with margin smooth-erose; midrib prominent, glabrous. Chromosome number unknown.

Known only from the type collection from pine-oak forests near Ocotlán, Oaxaca (Fig. 11), 1600 m . Flowering date, Aug.

## 5. Series Longipila Stuessy, ser. nov.

Herbae annuae; folia late ovata, subtus sericea; ligulae flavae-aurantiacae, plus quam 2 mm longae; involucrum extimum marginibus herbaceis; fructi apice arista adaxiali complanato cirrhoso. Species 20. Typus: Melampodium longipilum Robins.
20. Melampodium longipilum Robins. Proc. Amer. Acad. Arts \& Sci. 27:173. 1892. TYPE: MEXICO: San Luis Potosí, San José Pass, 11 Jul 1890, C. G. Pringle 3639 (Holotype, GH!).

Melampodium villicaule Greenm. Field Col. Mus. Pub. Bot. 2:345. 1912. TYPE: mexico: Guerrero, Río Balsas, 26 Aug 1910, C. R. Orcutt 4386 (Holotype, F!).

Annual herbs, $7-30 \mathrm{~cm}$ tall. Stems erect, $0.7-4 \mathrm{~mm}$ diam, villous with hairs 2 mm long. Peduncles 2-11.5 cm long. Leaves with short and broad petioles (rarely sessile) 3-6 mm long, with blades ovate to elliptic, 2-7.5 cm long, 0.5-3 cm wide, at apex acute, at base attenuate to partially subauriculate, with both surfaces pilose with hairs 1 mm long; margin entire. Heads $5-7.5 \mathrm{~mm}$ tall, $7-12 \mathrm{~mm}$ diam. Outer involucre markedly cupulate, $6.5-9.5 \mathrm{~mm}$ diam; bracts 5 ,
slightly connate at base, imbricate $1 / 2$ their length, ovate, $3.5-5 \mathrm{~mm}$ long, $2-3.5 \mathrm{~mm}$ wide, at apex acute, with abaxial surface pilose with hairs 1 mm long; margin herbaceous. Fruits $2.2-2.8 \mathrm{~mm}$ long, with lateral surfaces tuberculate or striate with tapering cirrhous appendages up to 8 mm long. Ray florets 7-8; ligules yellow-orange, ovate-elliptic, 3.5-5.5 mm long, $1.8-4 \mathrm{~mm}$ wide. Disc florets $40-70$; corollas yel-low-orange, 1.2 mm diam, with throat 0.8 mm and tube 0.5 mm long. Paleae oblanceolate, 3.5 mm long, 0.8 mm wide; apex yellow, with margin laciniate-dentate; midrib prominent, pubescent with hairs 0.5 mm long. Chromosome number, $n=10 .^{13}$

Scactered in tropical deciduous and pine-oak forests of western Guatemala and the Mexican states of San Luis Potosí, Hidalgo, Puebla, Guerrero, and Oaxaca (Fig. 12), $1370-3050 \mathrm{~m}$. Flowering dates, Jul-Nov.

In my opinion this species is morphologically closest to M. tenellum, although Turner and King (1962) have suggested that its relationship is with $M$. divaricatum (in section Serratura). The unusual adaxially flattened appendage (Fig. 8) makes $M$. longipilum unique within the genus, and this feature along with other characters such as large ovate leaves and markedly cupulate outer involucres suggests separation of the species as a monotypic series. Considered somewhat rare before the present treatment, M. longipilum is quite common especially throughout Oaxaca.
representative specimens. Guatemala. huehuetenango: Cumbre Papal between Cuilco \& Ixmoquí, 19 Aug 1942, Steyermark 50916 (f, Ny). Mexico. guerrero: 19 mi N of Chilpancingo, 29 Aug 1965, Stuessy 374 (TEX). hidalgo: Metztitlán, SE of Metztitlán, 24 Nov 1942, Moore 2283 (GH). oaxaca: ca 64 mi SE of Oaxaca, 23 Jul 1960, King 3461 (DS, NY, TEX, UC, US) ; 13 mi NW of Tehuantepec, 23 Aug 1965, Stuessy 328 (tex) ; 3.8 mi NW of Huajuapán de León, 25 Aug 1965, Stuessy 344 (tex) ; 10 mi NW of Tehuantepec, 11 Aug 1966, Stuessy 634 (os, TEX); 51 mi NW of Tehuantepec, 11 Aug 1966, Stuessy 636 (tex) ; 87 mi NW of Tehuantepec, 11 Aug 1966, Stuessy 637 (TEX); 28 mi S of Zimatlán, 12 Aug 1966, Stuessy 639 (TEX). puebla: Tehuacán, Sep 1911, Purpus 5619 (GH, ny, UC) ; near

[^12]Tehuacán, 36 Aug-8 Sep 1905, J. N. \& J. S. Rose \& Painter 10137 (US) ; Asunción de Chila, 25 Aug 1965, Stuessy 346 (TEX); 32 mi NW of Huajuapán de León, 25 Aug 1965, Stuessy 347 (TEX); 2 mi NW of Tehuitzingo, 16 Aug 1966, Stuessy 667 (TEX). SAN LuIS potosí: Villar, 14 Sep 1893, Pringle 4537 (F, G, NY, UC, US [2]). (To be continued)


[^0]:    ${ }^{1}$ Publication No. 795 from the Department of Botany, The Ohio State University, Columbus.

[^1]:    ${ }^{2}$ See Stuessy (1971b) for a reassignment of these chromosome counts to the presently recognized taxa.
    ${ }^{3}$ Due to the generic transfer of $M$. camphoratum ( $n=16$ ) back into Unxia (Stuessy, 1969b), this number no longer belongs in Melampodium.
    ${ }^{4}$ Because of recent counts of $n=12$ for $M$. dicoelocarpum (Stuessy, 1971b), the $n=23$ count for this species seems best interpreted as an aneuploid at the tetraploid level on a base of $x=12$.

[^2]:    ${ }^{5}$ In the keys and descriptions head diameter excludes the outer involucral bracts.

[^3]:    ${ }^{6}$ Fruit length in the key and descriptions excludes hoods and appendages.

[^4]:    'The method of citing specimens on Interdocumentation (IDC) microfiches described by Hepper (1968) is used here throughout the text. Taking the above citation as an example, the first number (800) refers to the specific herbarium in the IDC collection (here G-DC) followed by the numbers of: the individual microfiche (927), the particular line on the card (III), and the specific frame (三specimen) on the line (1).

[^5]:    ${ }^{3}$ One collection, Palmer 3 (F), has fruits with hoods and no hoods in one head of the single plant.

[^6]:    ${ }^{9}$ The holotype has fruits possessing hoods with both mucronate and cirrhous apexes.

[^7]:    representative specimens (SMALL FORM). Mexico: nuevo león: S of Nuevo Laredo, 8 Jun 1935, Clark 6635 (Ny); 15 mi N of Sabinas Hidalgo, 12 Jun 1967, Stuessy 854 (tex). tamaulipas: 5 km S of Nuevo Laredo, 11 Nov 1961, Domínguez 63 (TEX); 24 km S of Nuevo Laredo, 24 Mar 1962, Domínguez \& McCart 8217 (SMU, TEX) ; 59 mi N of Sabinas Hidalgo, 12 Jun 1967, Stuessy 857 (TEX). UNITED STATES. Texas: cameron co., Santa Ana National Wildlife Refuge, 26 Sep 1961, Fleetwood 3840 (tex); dimmit co., 3 mi W of Bigwells, 21 Apr 1945, Shinners 7395 (GH, Ll, SMU, UC) ; duval co., 4 mi NE of Freer, 8 Oct 1954, Tharp \& Johnston 541 [802A] (TEX) ; frio co., 5.5 mi S of Pearsall, 1 May 1954, Johnston, Tharp \& Turner 3472 (Smu, tex) ; hidalgo co., 6 mi E of Sullivan City, 8 Mar 1959, Turner 4490 (TEX) ; JIM HOGG Co., 8 mi E of Hebbronville, 12 Jun 1952, Jones 719 (SMU); Jim wells co., near Alice, 21 Jun 1935, Drushel 10441 (Ny) ; LA SALLE Co., 1 mi W of Encinal, 21 Apr 1963, Sánchez 105 (SMU, TEX); MAVERICK Co., 1 mi E of Eagle Pass, 22 May 1898, Bray s.n. (tex) ; starr co., 5.8 mi E of

[^8]:    representative specimens. Mexico. tamaulipas: 20 mi E of San Fernando-Santander Jiménez hwy on rd to Loreto ( 11 mi W of Loreto), 15 Sep 1960, Crutchfield \& Johnston 5527 (TEX); 13 mi E of Abasolo turnoff on the Santander-Jiménez-Pesca rd, 15 Dec 1960, Crutchfield \& Johnston 6141b (TEX); 48 mi S of Reynosa, 19 Oct 1959, Graham \& Johnston 4378 (TEX); 1 mi N of San Fernando, 4 Jul 1966, Stuessy 450 (tex); ca 2 mi SE of Reynosa, 4 Jun 1967, Stuessy 778 (tex); 27 mi S of Reynosa, 4 Jun 1967,

[^9]:    ${ }^{10}$ In one head of an isotype collection (UC) are found both smooth and roughly tuberculate fruits.

[^10]:    ${ }^{11}$ Although hoods are usually rudimentary in this species, a few coiled awns on small hoods are found in Feddema 1219 from Nayarit.

[^11]:    ${ }^{12}$ In the collection Shreve 6758 (US), most flowering heads have fruits with long cirrhous appendages, but in one head all the achenes are muticous or only very slightly mucronate.

[^12]:    ${ }^{18}$ See Stuessy (1971b) for a discussion of the $n=11$ count for this species.

